The Rural Broadband Initiative

Toward a New Model for Broadband Access in Haiti and Beyond

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About Inveneo:
Inveneo is a 501(c)(3) non-profit social enterprise whose mission is to connect and empower rural and underserved communities in the developing world with information and communications technologies (ICTs). Inveneo enables NGOs, governments and other organizations to more effectively deliver vital education, healthcare, development, and relief services to some of the poorest communities in the world. Inveneo partners with local ICT entrepreneurs to deliver and support these solutions locally. Since 2006, Inveneo and its certified ICT partners have delivered innovative solutions to that reach more than 1.5 million people in 25 countries in sub-Saharan Africa, South Asia, and Haiti.

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Cover Photos:
1. Inveneo’s CIO, Mark Summer, installs a network antenna in Léogâne
2. Inveneo’s initial broadband network in Port-au-Prince immediately following the earthquake
3. NGO staff working in Léogâne, Haiti with high speed broadband
4. Video conferencing capabilities connect Hôpital Sainte Croix in rural Léogâne with University of Notre Dame medical experts
5. Jerry Joseph, Inveneo’s first IT trainee (“Bati”) in Haiti
Background

In recent years, the economic and social benefits of broadband connectivity have become increasingly evident. On the economic side, the World Bank estimates that every 10% increase in broadband penetration can yield an increase of as much as 1.4% in GDP growth. It is clear as well that broadband Internet has even greater potential impact than voice connectivity alone. But the impacts of broadband are not merely economic. As recent events in the Middle East and North Africa demonstrate, the Internet, and broadband in particular, can be a power force for social change, fostering greater social inclusion, civic participation and political transparency, not to mention improved education, healthcare, relief, and more. The debate among policymakers has now shifted from whether to promote broadband access to the question of how to do so most effectively.

In rich and middle-income countries, governments are answering this question through regulatory reforms designed to promote private investment in broadband service and by creating financial incentives for private providers, often by expanding “Universal Service Funds,” initially designed for voice, to include subsidies for the extension of broadband services to underserved regions. Approaches still vary between relatively market-driven and more state-led strategies, but even the relatively laissez faire USA is now moving toward significant public investments in expanding domestic broadband access.

Unfortunately, despite evidence that broadband networks may have their greatest positive social and economic impact in poor and underserved communities in the developing world, it is in precisely these settings that regulatory reform and market forces are least likely to lead to increased service coverage to the “first mile” and where the public resources necessary to foster expansion are in shortest supply. On the one hand, “standard” technologies and operating models developed for use in typical urban settings are not well suited to low density, rural and poorer settings where low average revenue per user (ARPU) cannot support relatively high capital and operating costs. Additionally, there is general agreement that broadband’s full social and economic potential requires not just a reliable network and affordable devices, as with more market-driven telephony, but simultaneous investments in areas as disparate as user training, and the creation of valuable, relevant and accessible applications and content. For these and other reasons, the poorest and most marginalized communities in the developing world face a disproportionately large broadband “access gap,” and are falling further behind each day.

As Figure 1 shows (next page), just 9.6% of the total population in Africa has access to the Internet. This is less than 1/5th and 1/6th of the rate in the Americas and Europe, respectively. But this statistic does not convey the real situation in the world’s poorest countries. Of Africa’s 48 sub-Saharan countries, 29 (60%) have total Internet usage rates (at any speed) of less than 3%, and 15 (31%) show less than 1%. Broadband access rates are far lower still. Thus, while wireless broadband has exploded in much of the world, as the ITU’s 2009 report points out, there remains “a dramatic broadband divide, with very few fixed broadband subscribers or mobile broadband subscriptions in Africa.”

Inveneo believes that closing the broadband gap will require new, collaborative and low-cost broadband service delivery models. Moreover, we believe that the essential components of such a model already exist; what’s needed is a well-conceived and coordinated effort to bring them together in a functioning service delivery framework. As described in the following section, Inveneo and partners are working to define and deploy a novel, locally sustainable wireless broadband delivery model, starting in Haiti.
The Haiti Rural Broadband Initiative

The Inveneo-led Haiti Rural Broadband (HRB) initiative is a collaborative program seeking to catalyze sustainable broadband access in underserved parts of Haiti. The program is founded on the idea that dramatic capital and operating cost savings can be realized through the use of ultra-low-cost wireless technologies, an emphasis on building local IT capacity to deploy and support broadband infrastructure and new approaches to cooperative network ownership and management. HRB’s primary short-term objective is to bring affordable, reliable and sustainable broadband access to 6 regions and 20 currently un-served population centers across Haiti. The longer-term goal is to explore how the HRB model can be replicated in similarly rural and low resource areas across the developing world.

What follows is a brief description of the key components of the HRB initiative, followed by a discussion of the main factors that we believe will influence its replicability beyond Haiti.

An “Ecosystem” Approach

Because the value of broadband depends on a range of mutually reinforcing factors, only a multi-faceted and integrated initiative can hope to stimulate the growth and efficiencies that, in the mid-term, are essential if broadband access is to become sustainable. Governments are the usual convening force behind broadband expansion programs, but where they are weak, distracted or otherwise incapable of playing this role, non-governmental actors can still make significant progress. The HRB initiative consists of an eco-system of stakeholders – including catalytic donors, ISPs, local IT entrepreneurs, implementing partners and strategic “anchor tenants” (see below) – dedicated to the idea that a well-structured partnership can deliver substantially increased broadband access at low

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* Estimate
** Commonwealth of Independent States
Regions are based on the ITU BDT Regions, see: http://www.itu.int/ITU-D/ict/definitions/regions/index.html
Source: ITU World Telecommunication ICT Indicators database

Figure 1: Internet Access (% of population)
cost and without the direct involvement of the Haitian government. Nevertheless, should government support become available, it would clearly help to accelerate the rate of service expansion. See Appendix A for a list of Consortium Partners and Appendix B for a mapping of key players, inputs and trends.

Ultra Low-cost Wireless Technology
The single greatest impediment to market-based provision of broadband service in underserved areas is the high cost of deploying these networks. Proprietary, commercial technologies designed for high density, urban markets increase both capital and operating costs and are not well suited to rural and low-density settings. Thanks to dramatic improvements in performance and reductions in the cost of off-the-shelf radio networking solutions, it’s now possible to deploy reliable and complex broadband networks at much lower cost. These solutions have the added benefit that they are based on open standards, including 802.11/WiFi, which make them relatively easy to deploy and support, and require very little power to operate in point-to-point networks. To our knowledge, HRB represents the first attempt to deploy these technologies in a national-scale connectivity initiative.

Carrier-Neutral and Shared Network Infrastructure
Towers and power systems alone account for most of the capital costs of wireless network deployments. In response, many policymakers now encourage or even mandate a “shared infrastructure” regime in low-density and poor areas. The HRB initiative takes the principle of shared infrastructure one step further by working with service providers and strategic customers to leverage existing infrastructure to support the network (e.g., towers, relay sites, security) and reduce costs. The HRB network itself will be carrier-neutral - cooperatively owned and operated to allow service providers access to the network on a non-discriminatory basis - and will ensure price competition and open access for customers. It is important to note that the Haiti-based legal entity that will own and manage the network infrastructure will not be an ISP itself and is therefore exempted from licensure requirements.
Local Entrepreneurship and IT Capacity

One reason why carriers don’t invest in serving remote and low-density areas is the associated and relatively high cost of deployment and support. To help reduce such costs, Inveneo has developed the “BATI” program (in Creole, “Bati Anfòmatik Teknisyen yo ak Inveneo” or “Building Information Technicians with Inveneo”), which identifies and trains local entrepreneurs (our goal is to certify 2 BATI in each population center, 40 overall) capable of connecting new users to the network and providing ongoing IT support. BATI, which is modeled after Inveneo’s successful ICIP Program, is designed to lower operating costs for carriers, increase network uptime while also promoting local income generation. As independent service providers, BATI entrepreneurs build their businesses by providing install and support services to ISPs and general IT services, including appropriate computing solutions, to broadband customers. Inveneo has partnered with Fonkoze, the largest microfinance organization in Haiti, to provide secured startup loans to BATI entrepreneurs once they have completed training and have signed contracts with a service provider.

[Figure 4: Inveneo's first "Bati" consultant helping a client]

Low Bar for Participation

Many broadband initiatives get hung up around negotiations with incumbent carriers about the shared investments necessary to achieve expanded service. By combining extremely low overall deployment costs, trained local support capacity and catalytic seed funding for network rollout, all within a flexible roll-out plan, the HRB initiative is designed to entice ISP participation while also reducing their ability to obstruct the program. With progress on the first backbone links to the Central Plateau already underway, we anticipate that the incentives to join the program will increase significantly once our first customers (outside of Léogâne) begin to come online. To date HRB program leads have reached agreement in principle with several of Haiti’s leading ISPs, suggesting that this model is working.

Focus on Strategic “Anchor Tenants”

Few individual Haitians living in our target population centers can afford a personal broadband Internet connection or the computing equipment to take full advantage of it, however low the cost. HRB is therefore working to identify organizations – from schools, to hospitals and clinics to aid and relief organizations – that will serve as initial clients for the network. These organizations have the resources to pay for services to support their own operations and service delivery. They are also well positioned to make broadband directly accessible to the local population through programs that leverage shared, appropriate computing infrastructure (e.g., schools, community knowledge centers, etc.). HRB is initially targeting 6 regions in Haiti selected, in part, based on their relatively high concentration of potential anchor tenants – both public and private - and their stated demand for broadband connectivity.

The Haiti Rural Broadband program is still in its early days and many of the distinguishing elements described above are not yet fully defined. Together with our partners in this effort, we look forward to providing routine updates on our progress as well as lessons learned along the way. Meantime, if the HRB initiative is successful, where else might it take root?
Beyond Haiti – Toward a Repeatable Rural Broadband Service Model

This section lays out Inveneo’s initial thoughts on the main factors influencing the replicability of what, in its generic form, we’ll call the Rural Broadband Service Model (RBSM). For each factor, we discuss the specific situation in Haiti and then pose key questions that should be asked when considering whether some version of RBSM is appropriate in other low-resource settings. The relative importance of each factor is likely to vary from case to case, but the factors are discussed below in what we see as descending order of importance.

Legal/regulatory Environment

Like all such efforts, the RBSM can only take root in a hospitable legal and regulatory environment. Although government funding/subsidy is not an essential part of the model, explicit government backing and/or financial support for the program can help minimize risk (e.g., regulatory uncertainty) and accelerate impact. In Haiti, although there is no active Universal Service Fund to support the HRB initiative, Inveneo has worked directly with the national telecom regulator (Conatel) to ensure that the HRB model does not run afoul of existing or planned regulations. Moreover, the use of open frequencies is permitted throughout the country.

Key questions:
1. Are there legal or regulatory obstacles to the use of “open frequencies” (802.11x) or voice over Internet (VoIP)?
2. Do laws permit the creation of cooperative ownership structures (which could be seen as collusive under some legal regimes)?
3. Does the regulatory authority have an expressed goal of extending broadband to un-served areas?

Physical Environment

Low-cost networking technologies are central to the RBSM. At present, the absolutely lowest cost solutions use WiFi (802.11) and open frequencies (2.4ghz and 5.8ghz) which require line-of-sight between radios. Both topography and vegetation are therefore critical factors as they can impede point-to-point wireless links.

Haiti’s physical environment combines both good and bad scenarios for wireless networking. The Central Plateau region is, in many ways, perfectly suited to point-to-point wireless, with high peaks surrounding wide, open valleys and limited forest cover. In the Southwest, on the other hand, mountains and dense forest will make reaching large numbers of customers more challenging. Figure 5 (next page) presents our initial plan for the backbone network in Haiti.

In general, the RBSM is less likely to be successful in mountainous and densely forested regions (e.g. Coastal West Africa) than it is in the more arid and open settings (e.g. East Africa). Regardless of terrain, targeted regions that are extremely remote, and would require a large number of relays, may not be reachable using terrestrial Wifi backhauls, and may require alternative backhaul infrastructure.

Key questions:
1. Does the region’s topography, especially mountains, hinder or benefit the deployment of wireless network links to major population centers and anchor tenants?
2. Is forest cover likely to require construction of high towers at each location?
3. What distances must be covered to link target regions?
Anchor Tenant Demographics

RBSM relies on a baseline level of demand for service; typically from organizations that are already providing vital services – e.g., education, health, relief, etc – in targeted areas.

As the poorest country in the Western Hemisphere, Haiti has long been a focal point for international aid and relief organizations. The devastating Haiti earthquake of 2010 only increased their numbers and prompted many to extend their work outside of Port-au-Prince. Inveneo used the Haiti NGO Aid Map (http://haiti.ngoaidmap.org/), other open-source mapping tools and our on-the-ground experience and contacts to identify clusters of potential anchor tenants. These clusters served as the starting point for our network design efforts.

Key questions:

1. What level of expressed demand is there for broadband service among potential anchor tenants?
2. What is the density and distribution of this demand?
3. Does the distribution of possible anchor tenants coincide with popular demographics?
4. Are government bodies (e.g., Min. of Education, Health, etc.) open to serving as anchor tenants?
Carrier/ISP Market and Internet Bandwidth

All things being equal, RBSM is best suited to settings with several existing and similarly sized ISPs operating in a competitive market such that no single carrier is able to obstruct program rollout. Additionally, there must be adequate Internet connectivity into the country/region to support nascent demand at a cost that the market can bear.

As noted above, most of Haiti’s leading ISPs/carriers have expressed an interest in joining the HRB initiative and conversations with others are ongoing. Inveneo and its partners are also working on ways to increase total Internet bandwidth into Haiti, possibly via adding a spur to an existing, offshore fiber optic cable.

Key Questions:
1. Is the ISP market competitive?
2. How many ISPs operate and what is their existing service coverage area?
3. Do ISPs compete in the same geographical regions?
4. What type of Internet connectivity is available to ISPs at the wholesale level and at what cost?
5. Can the anticipated increase in total Internet demand be met through existing or new Internet capacity?

Existing Infrastructure

Keeping costs low requires shared infrastructure and a leveraging of what already exists. Note that key infrastructure is not limited to that controlled by ISPs/carriers. In addition to negotiating access to ISP/carryer towers, in Haiti Inveneo is also exploring access to towers owned by the country’s hundreds of small radio stations and anchor tenant locations as well. See figure 5 for our initial backbone network plan, which leverages a combination of carrier/ISP towers, radio station towers and likely anchor tenant facilities as well.

Key Questions:
1. What physical resources do the ISPs control (especially power and towers)?
2. What additional physical infrastructure (radio towers, etc.) can be leveraged to support the network?
3. Where are these assets located in relation to target customers/population centers?

Human Capital

Capable, local ICT support is central to the RBSM. This capacity can be achieved through incremental training, but depends on availability of professionals who already have at least basic ICT knowledge and experience. In Haiti, Inveneo is working through existing training institutions as well as mass media to identify “BATI” entrepreneurs that will contract with ISP directly to help connect clients. To date, these efforts have yielded an impressive response, with more than 60 candidates whose stated qualifications meet our initial screening criteria. The first BATI training, held in Mirabalais in mid-March, 2011, yielded 11 solid trainees for the Central Plateau region. Follow up trainings will take place in May. Our goal is to certify 2 BATI in each of the 6 regions we are currently targeting.

Key Questions:
1. Are there IT professionals capable of being trained to deploy and support network infrastructure in the region targeted for service?
2. Is the business opportunity sufficiently enticing to draw entrepreneurs into rural and remote settings?
3. What existing institutions can help identify and recruit trainee candidates?
4. What incremental infrastructure is required to deploy the planned network backbone?

5. In addition to physical infrastructure, what existing human capital (e.g., security personnel) can be leveraged to help reduce operating costs?

Core Services

Shared, networked services and applications can increase the value for anchor tenants at lower average rollout costs. Local network services that do not require Internet bandwidth are especially valuable in settings where such Internet bandwidth is scarce. In Haiti, Internet bandwidth sells at a premium due to limited fiber connectivity into the country. Inveneo and partners are exploring services/apps, such as video conferencing solutions for health and education, that add value without incurring Internet connection fees.

Key Questions:

1. What network-enabled services (e.g. VoIP, video conferencing, network management, etc.) can be leveraged across the shared infrastructure?

2. What content/application development resources exist in the local setting?

Language and Culture

All things being equal, regions with shared language and cultural traits will allow a higher degree of leverage of localized content and network services. Haiti’s common national languages (French/Creole) help to increase leverage of services/app/content while also minimizing overall communications costs, including marketing.

Key Questions:

1. How culturally and/or linguistically homogeneous is the targeted service region?

Conclusion

As much of the world sprints ahead as a result of significant public and private investments in broadband Internet connectivity, large parts of the developing world, especially the poorest countries in Africa, remain largely disconnected. As a result, and despite convincing evidence that broadband connectivity can foster significant economic and social benefits, these countries fall further behind every day. Narrowing this broadband access gap will require new rural broadband service models that radically lower capital and operating costs, and thereby the ARPU threshold for sustainability, of broadband networks.

The good news is that the key components of a sustainable RBSM already exist; what’s needed is experimentation around how these building blocks are best assembled, operationalized and scaled. The Haiti Rural Broadband initiative seeks to demonstrate that catalytic investment in shared, low-cost infrastructure, when combined with local IT capacity building and maximum leverage of existing infrastructure, can bring sustainable broadband Internet access to hundreds of organizations and, through them, many thousands or even millions of individuals for the first time. Based on learnings in Haiti, our goal is to define a RBSM framework that will facilitate the replication of similar, appropriately modified programs in other low-resource settings.
Appendix A – The HRB Consortium

The Haiti Rural Broadband Initiative reflects a growing consortium of partners, each of which is described in brief below (alphabetical by category).

**Catalytic Funders:**
- Aruba Networks
- Clinton Bush Haiti Fund – Core funding for expansion beyond Léogâne region and build out of the BATI program
- Craigslist Charitable Foundation – Seed funding for early work in Léogâne
- The EKTA Foundation – Initial funding for disaster response in Port-au-Prince and proof of the HRB concept in Léogâne
- Google – funding for the development and documentation of an effective network ownership and governance model for Haiti
- Microsoft – Funding for BATI training
- The Orr Foundation
- ZeroDivide – Seed funding

**Program Implementation Partners:**
- Hewlett Packard (HP) – Grant of equipment to support the related Connected Schools initiative
- Inveneo – Overall program implementation, including governance, infrastructure deployment and ICT/BATI training
- Microsoft – Strategic partner providing funding for the BATI training and initiator of the Haiti Connected Schools initiative, providing funding for deployment of ICTs in 40 Haitian schools
- NetHope – Strategic partner with post-earthquake emergency relief ad hoc wireless network, and with Phase Two program, identification and training of IT students and professionals throughout Haiti
- USAID Global Broadband and Innovations Alliance – Support for monitoring and evaluation

**ISP Partners:**
- Multilink
- Voila

**Strategic Anchor Tenants**
*(Partial list, Léogâne only):*
- All Hands Development Relief
- Caritas Cordaid
- CHF (Léogâne)
- Habitat for Humanity
- Hôpital St Croix (Léogâne)
- International Federation of the Red Cross
- Oxfam Quebec
- Save the Children
- Swiss, German, Canadian, Spanish Red Cross
- UNHCR
- World Food Program

**BATI Recruitment Partners:**
- Ecole Supérieure d’Infotronique d’Haïti (ESIH)
- ETRE Ayisyian
- NetHope Academy
Appendix B – Market Map
Notes:


iii Yongsoo Kim, Tim Kelly, and Siddhartha Raja, Building broadband: Strategies and policies for the developing world, Global Information and Communication Technologies (GICT) Department, World Bank January 2010


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Market Access Gap Model

Navas-Sabater et al (2002) use the above model to describe the “market gap”, which can be closed through appropriate, market-oriented reforms, and the remaining “access gap”, which can only be closed through non-market interventions that push back the “sustainability frontier”.

While market-friendly reforms are important and may be a prerequisite of progress in settings where there is little competition and/or regulatory uncertainty, HRB partners believe that in most countries the “access gap” can be narrowed most effectively through a combination of low-cost technologies, extreme leverage of existing assets and capacity-building that drives local entrepreneurship while reducing costs of deployment and support.


vi Arturo Muente-Kunigami Juan Navas Sabater, Options to Increase Access to Telecommunications Services in Rural and Low-Income Areas, Pg 7. “As new technologies with lower costs are becoming available, universal access policies can be more ambitious without necessarily incurring in higher costs or continuous subsidies.”

vii Indian law requires that operators share access to towers that are financed through the governments Universal Service Obligation Fund (USOF) for the first 5 years. In Tanzania, Ericsson’s Rural Netco (http://ruralnetco.com/) will provide a shared network infrastructure for operators serving remote parts of the country.