

# A New Model for Rural Connectivity

Al Hammond & John Paul, March 2006

The start of the 21<sup>st</sup> century may well be remembered as the turning point when providing telecommunications services to the rural parts of developing countries became not only technically and financially feasible, but also a strong priority among governments, development agencies, and the private sector. What is emerging is a new model that can harness the expanding power of wireless networks, low-cost technology, and entrepreneurship to create community-based communication networks and to provide over these networks a range of value-added services. The result is an opportunity to expand markets for telecommunication services, to empower local communities, and to expand economic capacity and commerce in rural areas.

## The Emerging Technology Model

### Regional Wireless networks—getting the Internet to the countryside

A critical element for rural connectivity common to all flavors of the new model is wireless networks. As equipment costs have fallen and capabilities have increased, it has become increasingly clear that wireless infrastructure is not only cheaper and easier to deploy than traditional wired alternatives, but makes possible business and service delivery models better adapted to rural and generally low income communities.

Several options exist to get Internet connectivity into rural areas. Cellular phone networks are expanding rapidly and provide some rural coverage, with the pattern varying widely by country. Many of these have no or very limited capacity to transmit data, but newer networks such as CDMA2000 have increased data capacity, and carriers are beginning to deploy even higher capacity networks in developing countries (2.5 G, 3 G, EV-DO, etc.). In most cases, these higher-capacity networks are being deployed simply to cope with the staggering growth in voice traffic, but they also have the capacity for data traffic. Generally, however, cellular systems are relatively expensive solutions for Internet access, even though mobility is often a useful benefit and cellular networks reach individual end-users directly.

A second option is fixed wireless technology, especially the WiMAX standard that is related to Wi-Fi hotspot technology but operates at much longer distances and has much higher data capacity than cellular networks. WiMAX networks can extend the reach of optical fiber backbones by up to 40 kilometers per hop (point-to-point) or distribute service to individual communities at distances of 5-15 kilometers (point-to-multipoint). WiMAX equipment is significantly less expensive than cellular and costs are expected to drop further—although end-user equipment is still much more expensive than a cellular phone. WiMAX technology—especially mobile versions now in development—is sometimes described as the basis for the next generation of cellular networks (4 G), although the fixed wireless versions are already being deployed in developing countries. In the model proposed here, WiMAX provides Internet connectivity to reach the rural community, especially the hub of a community network, but does not serve individual end users.



A third option, especially for more remote communities, is a new generation of satellite networks (VSAT) that are designed for data transmission. These pure IP VSATs include IPSTAR in SE Asia, the Hughes BGAN, and others, and they have higher data transmission capacity and generally lower costs for ground stations—in some cases as low as \$500 each. In the model proposed here, VSAT networks will bring Internet connectivity to communities, but like WiMAX networks, will not serve end users directly, other than commercial customers (e.g., branch offices of a banking chain or the hub of a community network).

### **Community Wireless Networks—linking phones, not computers.**

The challenge in rural communities is to both build demand and to aggregate that demand. Aggregating demand is the role a community wireless network, but building that network around voice services is critical to building demand—in large part because phones are easy to use, have low maintenance costs, and can support a wide range of voice-based and data services. Person-to-person communications has historically been the killer-app for telecommunication services and, in a rural context where literacy rates are low and most information needs are basic, demand for person-to-person communications is likely to remain primary.

The new model for community networks is based around Voice Over Internet Protocol (VOIP) telephony that sends voice traffic as data using the Internet's efficient packet-switching system rather than the circuit-switching system of traditional telephony. The phones themselves can either be traditional phones attached to a small conversion box or Wi-Fi phones that have the voice-to-data conversion built into the handset itself and connect wirelessly with a community Wi-Fi network, or even multi-mode cellular phones that have Wi-Fi chips built into them and can work on either cellular or Wi-Fi networks (see Addendum A). The key point is that phones on a VOIP system are Internet devices and use network capacity much more frugally than traditional phones—lowering bandwidth requirements and costs dramatically. Conversion boxes already cost less than \$50, and the chipset required to connect to a Wi-Fi network costs about \$15; Wi-Fi phones incorporating both are entering volume production and are expected to cost \$50 or less within a year.

New peer-to-peer networking software can set up or “switch” a VOIP phone call, and these “soft” switches are efficient enough to handle hundreds of thousands of calls on a single PC located anywhere on the Internet. The VOIP data traffic, however, travels directly between the two “peered” phones. That is important, because historically about 60% of voice traffic in local networks stays local—within the community—and thus uses only the local network capacity, another source of significant cost savings.

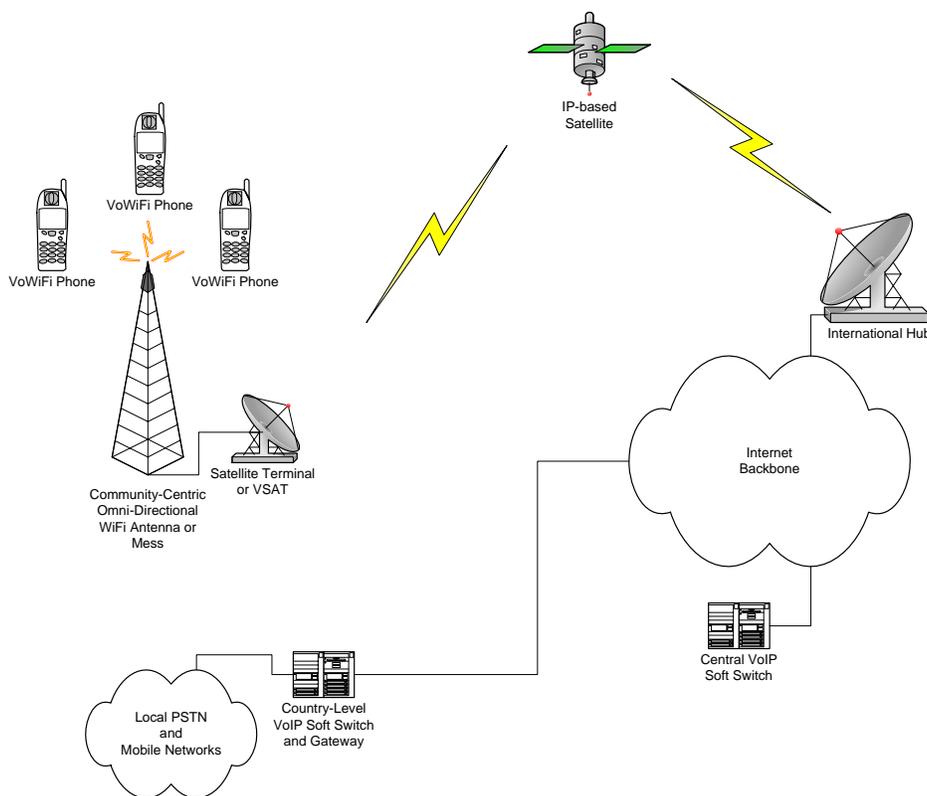
The community network that links the VOIP phones, in the new model, is a Wi-Fi fixed wireless network—either a single hotspot or a series of interconnected Wi-Fi nodes. Wi-Fi equipment is already a commodity, making the costs of such a network far lower than any other wireless network. In the most sophisticated version of a community network, the Wi-Fi nodes are a smart, “mesh” network that automatically finds and links with other nodes, routes signals in the most efficient manner, and can connect efficiently over a dozen hops in any direction—enabling coverage of an extended community. Moreover, some mesh equipment is designed for very low power and comes with solar panels and built-in battery storage. Such networks can be deployed “out of the box”, on poles or rooftops, without need for local power—and are thus ideally suited to rural conditions.



Although VOIP phones may be the main devices on such a network, the network can also support any other Wi-Fi-ready device—handheld computers, laptops, or PCs—enabling a wide variety of Internet services to be deployed if demand warrants.

### Summarizing the New Model for a Rural Community Telco

USAID's Darrell Owen has done a good job laying out the components of a fully-functional community-based telecommunications network built to serve the latent demands for local-community voice communications as described above. These include 1) an Internet Protocol (IP) network in lieu of a circuit switched network, 2) voice services that are provided through VoIP in lieu of custom hardware-based switching, 3) wireless distribution, be it Wi-Fi or WiMAX or, for the more remote locations, VSAT links for connecting the rural system to the Internet.<sup>1</sup>



**Figure 1: Rural Community Telco Architecture**

In this model, the local network is easily deployed, provides multiple telephony access points for both inter-community and long distance calling in addition to supporting data. The use of off-the-shelf technologies allows this to be done at a cost that is literally pennies-on-the-dollar compared to what has been possible in the past.

<sup>1</sup> Darrell Owen, "Community Telecom: A New Technical & Business Model," November 2005 (private communication)



There are several options for providing these services to the local community. One obvious approach is to upgrade an existing telecenter to become a true “last mile” solution provider by focusing on voice services, and delivering expanded access into the community through selected businesses or even homes that serve as “phone shops” for the immediate neighbors. Another approach is to turn an existing satellite or satellite-based phone into a local community telco by adding Wi-Fi/WiMAX distribution capabilities. Creating a new business from scratch, possibly with the technical support or financing assistance of an existing licensed carrier, is also an option.

### ***The Technologies***

**Internet** – packet switching replaces the industry-standard circuit switching, substantially reducing costs and allowing for the integration of additional value-added services.

**VoIP Soft-switch** – routes the packets to/from those making the call, and provides interconnection to the switched phone network.

**WiMAX & Wi-Fi** – standards-based fixed wireless for distributing Internet to rural areas and for last-mile community networks. Lower cost and with higher capacity than cellular networks.

**Mesh Wi-Fi** networks extend local community networks by inter-connecting access points and enable a low-cost way of covering an extended rural community.

**Wi-Fi Phones** – UT Starcom and ZyXEL are already producing VoIP-enabled handsets. In Vietnam, USAID is also piloting the use of a \$10, 900 Mhz VoIP cordless phone. Other handset manufacturers are pushing manufacturing costs lower. Motorola (\$30) and Infineon (\$20) both expect to introduce models in early 2006. Not all VoIP phones are SMS-ready, but the functionality can be added with minimal additional cost. Nokia has introduced a dual-mode Wi-Fi-enabled cell phone for under \$200.

**Satellites** – where terrestrial solutions are not available, satellites will allow remote communities to reach outside their network. New satellites, such as the IPStar and BGAN are providing IP services at a substantially lower cost than has been possible in the past.

### **Generating Local Demand and Creating Local Value--Voice-based Applications**

The development literature on the uses of information and communications technology amply documents<sup>2</sup> the benefits of inexpensive and timely access to information. Previously isolated communities not only gain access to relevant information, but also gain entry into the global marketplace, creating local wealth in areas ranging from financial services to agriculture. Telecommunication networks also enable communication and collaboration at the local level, and become increasingly valuable as more people are connected to them. But much of this promise has remained unfulfilled, because the technology was too expensive or too complex, or because relevant applications were not available that could drive demand and generate the payments to make local communications systems financially viable and sustainable, or because local entrepreneurs interested in operating local networks could not get financing, training, and support.

Beyond the revenue earned from traditional voice services, a number of value-added applications can improve the cost-effectiveness and sustainability of the local network.

<sup>2</sup> <http://www.digitaldividend.org/>



For existing or future telecenters that become local community telcos, additional earnings will help maintain operations while demand for pure data services steadily increases.

There are a number of mobile-enabled services that have already been deployed in emerging markets.

### **Financial Services**

Cell phones are increasingly being used to make financial transactions. In South Africa, for example, the WIZZIT<sup>3</sup> banking facility allows account holders to use their mobile to remit money to a friend, buy airtime, or pay accounts. The service was developed specifically to provide the unbanked and underbanked with an affordable alternative to mainstream bank offerings, and has no monthly fees and no minimum balance requirements.

Two companies from the Philippines have also rolled out similar plans. Globe Telecom's G-Cash<sup>4</sup> service allows subscribers to transfer funds domestically and internationally and make payments via texting. Authorized G-Cash outlets let users load or withdraw cash from their phones and receive international remittances. Another, SMART Communications<sup>5</sup> has enabled electronic sales of small increments of pre-paid airtime via SMS, creating a business opportunity for 450,000 entrepreneurs. In partnership with Mastercard, the company also launched Smart Money, a service which enables users to transfer money from a bank account to a Smart Money account. Subscribers can then use their Smart Money card like a debit card, or transfer money via SMS to another user's card.

Motorola recently unveiled M-Wallet<sup>6</sup>, a downloadable software application that allows users to pay bills, purchase products, or transfer money using their cell phones. The company is targeting the estimated \$18 billion that is sent annually from the U.S. to Latin America by immigrants and migrant workers as one of its early markets.

Mobile applications are also improving the delivery and scope of microfinance services. In Uganda, HP has partnered with three microfinance institutions (MFIs) to pilot a mobile transaction platform that lowers transaction costs and reduces fraud. The Remote Transaction System<sup>7</sup> enables financial data to be captured by a handheld device in the field and uploaded to the MFI over a cellular network. In Kenya, Vodafone has created a mobile-enabled version of an existing microfinance system. M-Pesa<sup>8</sup> creates a direct link between the MFI and its client, making financial transactions faster, cheaper, and more secure. The platform also lets the user withdraw and deposit cash (through local agents) and enables person-to-person transactions, opening the way to the largely untapped market for remittances. As a result, the MFI functions more as a full-service bank rather than just a loan-maker.

Finally, Way Systems<sup>9</sup> has designed a low-cost technology to transform cell phones into wireless Point of Sale (POS)/ATM Terminals, making it feasible for small and medium

<sup>3</sup> [http://www.wizzit.co.za/Wizzit\\_index.htm](http://www.wizzit.co.za/Wizzit_index.htm)

<sup>4</sup> <http://www.myglobe.com.ph/gcash/about.asp>

<sup>5</sup> [http://www.digitaldividend.org/case/case\\_smart.htm](http://www.digitaldividend.org/case/case_smart.htm)

<sup>6</sup> <http://www.redherring.com/article.aspx?a=15639>

<sup>7</sup> <http://www.nextbillion.net/node/1424>

<sup>8</sup> [http://www.microfinancegateway.org/files/30784\\_file\\_M\\_Pesa\\_CG\\_presentation.pdf?PHPSESSID=](http://www.microfinancegateway.org/files/30784_file_M_Pesa_CG_presentation.pdf?PHPSESSID=)

<sup>9</sup> <http://www.wayinc.com/>



sized merchants in developing countries to accept credit card payments. The company recently formed a strategic alliance with Visa International to explore opportunities for joint development of mobile commerce solutions.

### **Agricultural Services**

Agriculture information portals are reaching new audiences with mobiles. The Kenya Agricultural Commodity Exchange (KACE)<sup>10</sup>, in conjunction with mobile telephone company Safaricom, has developed an SMS system to give farmers access to market prices. FOODNET<sup>11</sup> provides a similar service to farmers in East and Central Africa. The SMS systems allow farmers to bypass exploitative middlemen, who often charge below-market rates to farmers with few other options in terms of crop sales. In addition, the system will help farmers manage their trips to market, which can become expensive in terms of travel costs and lost time in the fields.

Other companies provide the SMS service to drive traffic to their other online offerings. In the Philippines, B2Bpricenow.com<sup>12</sup> runs an e-marketplace through which farmers and cooperatives can market their wares, bypassing traditional trader networks that often manipulate market prices. Agriwatch<sup>13</sup> provides commodity research reports, industry news, and runs an online auction for Indian producers and suppliers. Subscription costs for the services are minimal and can be split between a group of farmers that share the information.

### **Health Services**

Mobile-enabled health applications can be used for both disease management and prevention. In South Africa, On-Cue Compliance<sup>14</sup> uses an SMS-based service to help reduce reoccurring medical problems that arise when people forget to take their medications. The company sends timely reminders to their cell phones using a low-cost open source software operating system. The system is currently being used in the treatment of tuberculosis patients in Cape Town with almost a 100% success rate. Also in South Africa, Cell-Life<sup>15</sup> has implemented a similar platform to improve the monitoring and treatment of HIV and other diseases. Health workers in the field use their cell phones to record patient data, improving efficiency and treatment, and lowering per-patient costs.

The for-profit Voxiva<sup>16</sup> has developed and implemented a technology platform that enables medical professionals to collect data in real-time and communicate with one another in order to effect change based on the data. By leveraging the web, phone, fax, email and SMS, the company provides a customizable solution that works over any voice or data system. Voxiva has worked with diverse partners to develop solutions to detect disease outbreaks, support HIV/AIDS care and treatment, monitor patients, track critical supplies, and enhance program management in some of the most challenging environments in the world including Rwanda, Iraq and post-tsunami South India.

<sup>10</sup> <http://www.kacekenya.com/marketinfo/sms.asp>

<sup>11</sup> <http://www.foodnet.cgiar.org/market/Latest%20Market%20News.htm>

<sup>12</sup> <http://www.b2bpricenow.com/contents/mainpage.asp>

<sup>13</sup> <http://agriwatch.com/smsService.asp>

<sup>14</sup> <http://www.on-cue.co.za/>

<sup>15</sup> <http://www.cell-life.org/>

<sup>16</sup> <http://www.nextbillion.net/files/Voxiva.pdf>



## Multi-Sector Platforms

As a software development company, Voxiva can readily adapt its tools for new applications. For example, the company helped NGOs and governments coordinate relief efforts and allocate resources in Indonesia's tsunami-ravaged Aceh Province. The Voxiva system is also being used to increase citizen participation in order to monitor, respond to and reduce crime in Peru.

WorldTalk<sup>17</sup> is another multi-sector platform. It delivers on-demand audio-based information over existing telephone networks and in the local-language. The system is designed to inexpensively provide reliable, up-to-date information in areas where literacy levels are low, computer access is limited, and local government services are overloaded. By providing information on issues such as housing, health, market pricing, legal rights, and employment, WorldTalk enables people in poor communities to improve their living conditions and develop themselves. The non-profit is currently piloting projects in South Africa and India.

What's interesting about WorldTalk and Voxiva is that essentially they are both customized software applications running on increasingly inexpensive hardware. With these basic platforms, there is no limit to the applications that could be developed to meet specific community needs.

## Summary

Improved lower-cost technologies are finally making it possible to erase the telecommunications divide that persists throughout rural developing areas. Demand for voice services in emerging markets is already so high that existing networks almost always run at full capacity, and evidence exists that latent demand in rural areas is huge. The powerful combination of Wi-Fi/WiMAX and VoIP now makes it possible to rapidly scale-up networks, offering a lifeline to communities with no fixed-line alternative. The low cost of deployment ensures that service costs remain affordable to the end user, while its ability to offer data services ensures long-term utility.

A number of SMS and voice-enabled applications are already in use in these markets, providing financial, agricultural, health and other information services. Many are being offered by established operators eager to expand their markets and increase customer loyalty. Developed to meet the needs of underserved people living at the base of the pyramid, these phone-enabled services are set to expand as coverage increases.

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<sup>17</sup> <http://www.worldtalk.org/>



## Addendum A: Wi-Fi Phones

According to a report by Infonetics Research, the global market for Wi-Fi phones rose 76 percent in 2005 to \$102.5 million, and will reach \$1.9 billion in 2009. The number of units shipped rose 112 percent last year, and will increase by 158 percent this year.<sup>18</sup> These figures represent demand primarily from developed markets. However, as Wi-Fi and WiMAX technologies enable the rapid expansion of telecommunications into rural developing areas, the market for Wi-Fi equipment will grow significantly. The resulting volumes will drive prices even lower, enabling many customers at the 'base of the pyramid' to enjoy the benefits of mobile services for the first time.

A number of Wi-Fi phones are planned or already available to take advantage of this emerging opportunity.

### Phones

#### 1. UTstarcom F1000 Wi-Fi VoIP Phone<sup>19</sup>



The F1000 residential Wi-Fi handset expands the reach of VoIP communications. It provides consumers a new cost effective way to communicate, and includes features such as 3-way Calling, Call Waiting, Call Transfer and many popular features. The phone is being sold under a number of different names (e.g. Vonage & BroadVoice), and costs about \$130.

#### 2. HOP1502 Wi-Fi IP phone<sup>20</sup>



Hop-on, Inc is launching the HOP1502 Wi-Fi IP phone and bundled software solution that allows users to make calls from any Wi-Fi hotspot. The new Wi-Fi handset supports a wide variety of VoIP features and functions based on the Session Initiation Protocol (SIP). Service providers can offer a range of call features, such as three-way calling, call waiting, call forwarding and more. The HOP1502 also enables voice processes, including comfort noise generation, voice activity detection, and echo cancellation, as well as IP protocol features such as Real-Time Transfer Protocol (RTP), Session Description Protocol, Dynamic Host Configuration Protocol (DHCP), and Virtual SIM (VSIM). The VSIM solution enables non-ambiguous identification of a handset, protecting it against impersonation, anti-replay and fraud. VSIM provides an encryption mechanism for the media flow itself, applicable to voice, data or video streams on the handset. The phone is expected to cost \$39.

<sup>18</sup> <http://www.voip-magazine.com/content/view/1725/>

<sup>19</sup> [http://www.utstar.com/Document\\_Library/0189.pdf](http://www.utstar.com/Document_Library/0189.pdf)

<sup>20</sup> <http://www.wifi-cell.com/>



### 3. Nokia 6136<sup>21</sup>



Mobile equipment manufacturer Nokia says it is unifying GSM and Wi-Fi connectivity with a new mobile phone that's compatible with both wireless standards. The 6136 is a quad-band phone that will connect to GSM networks at 850, 900, 1800, and 1900MHz, which means it will work in the US as well as Europe. It comes with a 1.3 megapixel camera and an FM radio, and supports microSD memory cards. Release is planned for the second quarter of 2006

### 4. ZyxEL's P-2000W VoIP Wi-Fi phone<sup>22</sup>



The brand new application is developed to support open standard SIP (Session Initiation Protocol), which interoperates with major SIP-based call servers, IP-PBXs and various VoIP client devices. It is not only an ideal alternative for ITSPs (IP Telephony Service Providers) to deploy their VoIP services; it can also be the wireless handset, which is applied in corporate IP-PBX centric VoIP environment. The phone's list price is \$250, but it is available for as low as \$150.

### 5. NETGEAR / Skype Wi-Fi Phone<sup>23</sup>

NETGEAR and Skype announced in January that they are working on a family of innovative new products, including the world's first Skype wireless mobile telephone and a router equipped to optimize Skype. The NETGEAR Wi-Fi phone will make mobile Internet telephony a reality for Skype users. No commercial release date has been announced.

### 6. Wi-Fi SkyFone WM1185-T<sup>24</sup>

Taiwan's Accton Technology planned to launch two wireless handsets by the middle of February. Like the NETGEAR model, the VM1185T Wi-Fi SkyFone, comes with a built-in version of Skype's popular Internet calling software. Accton's other phone, the VM1188T VoWi-Fi, isn't designed for Skype but will also allow users to place Internet phone calls using Wi-Fi. The company plans to market the phones in the U.S. and Europe first, followed by Asia. They are expected to cost \$100 to \$150 each.

### 7. GoDialing Wi-Fi Phone<sup>25</sup>

In December, Internet phone company [GoDialing.com](http://www.godialing.com) launched a portable Wi-Fi phone aimed at the mass market. The handset costs \$155.

<sup>21</sup> <http://www.europe.nokia.com/nokia/0,,85001,00.html>

<sup>22</sup> <http://www.zyxel.com/product/P2000W.php>

<sup>23</sup> [http://www.netgear.com/pressroom/press\\_releasesdetail.php?id=305](http://www.netgear.com/pressroom/press_releasesdetail.php?id=305)

<sup>24</sup> <http://pcworld.about.com/news/Jan102006id124313.htm>

<sup>25</sup> <http://www.govtech.net/news/news.php?id=97610>



## 8. Motorola CN620<sup>26</sup>



Specs for the Motorola CN620, the first phone capable of operating on both mobile and Wi-Fi networks, were released in summer 2004. The phone allows calls started on Wi-Fi networks to be handed off to a GSM network. Features of the phone include a large color main display, an external display, speakerphone, eight-way navigation, and PTT (push-to-talk).

**Note:** It doesn't look like the phone ever made it into full production. After the initial specs were released, it was revealed that the phone did not support 802.11b and g, severely limiting its use and appeal.

## Wi-Fi Chips

The majority of cell phones produced today are intended for use over GSM networks. This is also the case with the new batch of low-cost cell phones being designed by Motorola and others for BOP markets. As Wi-Fi infrastructure continues to be developed, however, there will be a strong consumer demand for chip-sets that allow phones to automatically switch between GSM and Wi-Fi networks. A number of chipset manufacturers have already started developing such solutions.

### 1. STMicroelectronics NV<sup>27</sup>

In February 2006, STMicroelectronics NV announced that it had begun mass production of its first cellular-phone wireless LAN chip. The company said its STLC4370 chip, based on 802.11g technology, provides power-efficient, high-speed wireless performance. The chip's compact design lets it fit into devices of different shapes and types, including the candy bar-style, compact PDAs and fold-open keyboard designs, STMicro said. The **chip costs US\$10** in quantities of 100,000 units.

### 2. Atheros Communications and Qualcomm<sup>28</sup>

[Atheros Communications](#) and [Qualcomm](#) on Feb. 10 announced plans to collaborate on mobile phone chip sets that support both cellular and Wi-Fi data transfers. Phones built based on the reference design should hit the market by the end of 2006.

### 3. Broadcom Wi-Fi Phone Chips<sup>29</sup>

Leveraging its award-winning 54g™ wireless LAN, field-proven Voice-over-Internet Protocol (VoIP) and video multimedia technologies, Broadcom is offering a family of chips and software that enable the development of Wi-Fi™ phones and Wi-Fi Video Phone products. The chipsets incorporate advanced multimedia features that enable Wi-Fi phones to display and transmit video, still images and high-resolution graphics. These solutions come complete with support for new emerging standards for voice over WLAN quality of service (QoS), Security and Power management.

Addition Wi-Fi phone information is available at <http://www.wifiphone.org/>

<sup>26</sup> [http://www.motorola.com/mot/doc/5/5608\\_MotDoc.pdf](http://www.motorola.com/mot/doc/5/5608_MotDoc.pdf)

<sup>27</sup> [http://www.infoworld.com/article/06/02/10/75269\\_HNstmicro\\_1.html](http://www.infoworld.com/article/06/02/10/75269_HNstmicro_1.html)

<sup>28</sup> <http://www.eweek.com/article2/0,1895,1925362,00.asp>

<sup>29</sup> <http://www.broadcom.com/products/Wireless-LAN/Wi-Fi-Phone-Solutions>



## Addendum B: Village Computers

Rural communities generally have had limited access to technology, and the cost of a PC is typically more than what the average villager can afford. Village telecenters have been started to provide shared-access to these technology tools, but many are unsustainable, due in part to the high cost of purchasing and maintaining the computers.

Today, two leading chip manufacturers are taking the lead on creating the first PCs designed specifically for use in rural village telecenters. These computers further increase the utility of a local community network, providing additional data services not available through a mobile phone.

### Intel's Community PC

Intel's community PC has been specially designed to work in the harsh conditions of rural environments. The low-power computer features a 1.3MHz processor, 256 MB RAM, a 40 GB HDD, a CD-ROM drive, 6 USB ports, and a standard VGA display.



The PC is installed, maintained, and operated by local firms that offer—through a trained mediator—a broad array of moderately priced computing services to rural residents in emerging markets. The device will provide massive rural populations access to the Internet and its associated business and personal communication connectivity. By aggregating demand and enable shared access, the computer makes entire rural villages, not individuals, the end-customer

#### Features/Benefits:

- Highly reliable system with remote diagnostics, remote control features, highly manageable.
- Capable of delivering online transactions, e-commerce, entertainment, information Kiosk,
- Large built-in storage capacity with high-speed IO
- Internet access with multiple connection units including wired, wireless, WiMax, and cable
- Multiple media interfaces including Smart/ID card reader and fingerprint reader
- Can function through the use of a car battery as its back-up energy supply

Intel plans to market the PC initially to India's 600,000 villages. The device is expected to cost about \$400.



### AMD's Personal Internet Communicator<sup>30</sup>



The Personal Internet Communicator (PIC) is an inexpensive computer specifically designed for use in the most challenging conditions at the BOP. Supported through a local service provider, the complete package includes monitor, keyboard, mouse, and pre-installed software. The sealed CPU does not contain a fan, in order to minimize damage from humid or dusty environments. Its portability also allows it to easily be secured in the evenings, if it's used in a school or Internet café.

Costing about \$250 with a monitor (\$185 without), the PIC is the first product of AMD's 50X15 initiative, a global commitment to empower 50% of the world's population with basic Internet service and computing access by the year 2015. In August 2005, AMD and Cable & Wireless announced the launch of the Max Personal Internet Communicator (PIC) in Jamaica, bundled with Cable & Wireless' High Speed Internet service.

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<sup>30</sup> <http://www.amdboard.com/pic.html>

