

The country's expanding Internet sector has largely bypassed the government's telephone monopoly, and outpaced regulatory reform, due largely to the innovative use of wireless technologies.

Lessons from Haiti's Internet Development

Haiti would not seem to be the most fertile ground for Internet growth. A weak economy, a low literacy rate, difficult terrain, political turmoil, and few working telephone lines outside the capital, Port-au-Prince, all conspire to inhibit Internet development.

Despite these impediments, resourceful entrepreneurs have sought to offer and expand Internet services, sometimes exploring unconventional technical approaches. After five years of commercial Internet services in the country, Haiti's four commercial ISPs now offer their services in five Haitian cities where they compete for a growing customer base of up to about 2,000.

The Haitian experience demonstrates that the shortest path to installing an Internet infrastructure in developing countries may be radically different from the paths taken in their wealthier counterparts. It also shows how policies regarding spectrum management, international telephone service and accounting rates, ISP

licensing, and the resale of service and access can influence Internet growth.

I focus here on how Haiti's entrepreneurs have found ways to leverage their strengths and circumvent their barriers, emphasizing the lessons Haiti provides on the Internet in developing countries, including how, for example, Internet

telephony can complicate Internet development and why spectrum management polices play such an important role.

Telecommunications Climate

There are clear reasons why infrastructure development is so challenging in Haiti. Autocratic rule and political turmoil have left a difficult legacy. François “Papa Doc” Duvalier and his son Jean Claude “Baby Doc” Duvalier ruled Haiti for almost three decades (1957–1986), and, despite their people’s oppressive poverty, amassed huge personal fortunes. The second Duvalier regime collapsed in 1986 after an open revolt. Years of crisis and instability have followed. The fragile current democracy was established in 1994, when Jean-Bertrand Aristide, the elected and deposed leader, returned from exile in the U.S.

This history has left Haiti among the least developed countries in the Western Hemisphere—a serious challenge for infrastructure development. Its per-capita gross domestic product is around \$250. (All monetary amounts in this article are in U.S.\$). Although there is a great need to build an information infrastructure to facilitate long-term economic growth and political stability, short-term needs, like health care, are also pressing. For example, roughly 11% of the babies born in Haiti do not survive to their first birthday. With illiteracy rates exceeding 60%, the number of people who could navigate the Internet is somewhat limited. Finally, the geography itself is not conducive to infrastructure development; as an island nation, Haiti is remote from every country except the Dominican Republic (with which it shares the island of Hispaniola), and mountainous terrain makes domestic interconnection expensive. Costs are further increased because 65% of the population lives in rural areas.

Haiti does, however, have one trait that is conducive to telecommunications growth—a large expatriate community in the U.S., Canada, and elsewhere, boosting demand for international communication services, even among those with relatively low incomes.

Telephone services throughout the country are provided by Telecommunications d’Haiti (Téléco), a government-owned monopoly. The telephone infrastructure is among the most limited in the world, making a lack of phone lines the preeminent impediment to Internet growth. Haiti has 0.9 phone lines for every 100 people—less than half of the average in Africa. Haiti has not pursued an active universal service policy [1]. If one excludes Port-au-Prince, Haiti has only 0.2 telephone lines per 100 people. Moreover, it often takes years to get a phone line; there is a

waiting list of roughly 100,000. Despite ambitious plans, there has been no significant increase in the number of phone lines in years. Service costs roughly \$10 per month. At any given time, roughly a third of the country’s phone lines are out of service.

Despite the limited domestic service, Téléco has been very profitable in most years. About 50% of its revenues come from international services, which are especially profitable, thanks to the high accounting rates for international telephone calls made from Haiti. Moreover, the government receives 25% of Téléco’s revenues, making it dependent on the company’s success. Recent talk of privatization offers a new way to bring more money into the government’s coffers, though revenue from privatization depends on Téléco’s profit, regardless of whether the company provides infrastructure that advances economic growth. Thus, as in many countries, one cannot address Haiti’s Internet policies without considering their effect on the monopoly telephone provider (see Petrazzini and Kibati’s “The Internet in Developing Countries” in this issue).

Other telecommunications services are also limited. Téléco does not provide pay phones or allow others to use phone lines for this purpose. In 1995, the government issued an open call for cellular licenses, prompting several companies to begin developing cellular infrastructure in Haiti, though cellular operation has been repeatedly delayed. The Internet is the one functioning telecommunications sector that is not completely controlled by Téléco.

Four ISPs

Haiti’s four commercial ISPs offer services in five cities to a total of 1,000–2,000 paying customers. (For comparison, the country has roughly 40,000 working phone lines). Despite the high costs of establishing Internet service, the number of customers is increasing.

Each of these ISPs has different histories, objectives, resources, and market niches. Each is responding in a different way to the challenges of the Haitian environment, where the most recurrent theme is the weakness of the telephone system.

Hintelfocus. MCI came to Haiti as a provider of telecommunications services for the U.S. armed forces and the U.S. embassy, without offering commercial services to the local population. But once any company establishes a satellite link for international communications, it finds it cost-effective to expand the link’s capacity and support other services. Eventually, an ISP called Hintelfocus emerged to exploit this resource.

Hintelfocus offers Internet services through its point of presence in Port-au-Prince, where it is co-

RESALE AMONG COMPETING ISPs IS AN IMPORTANT AND UNUSUAL FEATURE OF THE HAITIAN INTERNET SECTOR.

located with MCI's international gateway. MCI carries the international traffic over its satellite link. The connection with MCI gives Hintelfocus ready access to international communications capacity. In addition, although the company would probably be even more profitable with additional telephone lines, it has considerably more lines than its three commercial Haitian competitors. Given its relatively good access to telecommunications capacity, both domestic and international, Hintelfocus provides a typical Internet service based largely on dial-up access over the national telephone system.

The company's prices would be competitive in many countries. It charges a \$30 set-up fee, and customers requiring access for less than 25 hours per month pay only \$10 per month. Other packages are available for more frequent users who can afford to spend more per month.

Alpha Communications Network. Haiti's largest ISP, the Alpha Communications Network (ACN), became the country's first commercial ISP in 1993. ACN's history and orientation are very different from those of Hintelfocus. The original purpose of the system that became ACN was to support the internal needs of a large Haitian company. The company soon realized it could use the same equipment to provide telecommunications services for other businesses, a scenario followed by many ISPs around the world. ACN now has its own international satellite link, which it uses to carry Internet traffic and offer virtual private network (VPN) services for many businesses with offices in Haiti. As the Haitian ISP with the greatest international telecommunications capacity, ACN also provides the underlying communication services needed by the other ISPs.

Although ACN has ample international capacity, it has few local telephone lines. Indeed, its access to telephone lines has actually declined in recent years. After accusations were made from the rival MCI/Hintelfocus camp that ACN was providing international telephone services in violation of Téléco's monopoly, Téléco took back 67% of ACN's telephone lines. Although ACN denied the allegations, it still lost most of its dial-up customers as a result of the controversy.

ACN has responded to the scarcity of phone lines with an unusual strategy—deploying its own wireless infrastructure, completely circumventing the telephone

system. ACN installed transmitters on the premises of its major customers, providing dedicated connections between the customer and ACN's point of presence. ACN's main technology is Lucent's WaveLAN, which operates at 2.4GHz using spread-spectrum technology to facilitate spectrum sharing. Although WaveLAN was developed for very different purposes, like the indoor connection of computers to an office LAN, WaveLAN has also met the needs of ACN customers. WaveLAN systems have been modified as needed to address local conditions. ACN has used this approach to serve customers up to 20 kilometers from the company's point of presence. (This approach probably reinforced ACN's interest in focusing on customers in Port-au-Prince, but the company recently began offering services in a second city, Jacmel.) Clearly, this approach means that spectrum management is an important issue for Internet development.

With a business model based on dedicated wireless links, customers can expect good performance, as well as high initial costs for customer premises equipment, irrespective of monthly service charges. Internet connections to a single computer cost approximately \$2,000, and customers using their links to connect a bank of multiple computers pay several times that. Despite these costs, ACN has a waiting list of potential new customers.

Companet. For years, Companet has been a growing vendor of computer equipment and technical support in Haiti. As a result, it has technical expertise and established relationships with many potential Internet customers—another common and valuable springboard to becoming a commercial ISP.

Like ACN, Companet has severely limited access to phone lines for dial-up service and relies heavily on dedicated wireless links using spread-spectrum technology, so costs are comparable to those of ACN. Unlike ACN and Hintelfocus, Companet lacks a license from the government's regulatory authority that would give Companet access to its own international satellite connection; its application for such a license remains unanswered. Companet survives as an ISP by reselling ACN communications services. Not only does this benefit Companet, it enables ACN to expand its market and compete more effectively against Hintelfocus. Resale (international capacity in this case) among competing ISPs is another important

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and unusual feature of the Haitian Internet sector.

Globelsud. Like Companet, Globelsud provides Internet services by reselling ACN's international capacity. It also uses phone lines and dedicated spread-spectrum wireless links. However, Globelsud differs significantly from Companet and the other providers in that it targets a different market niche. Established only a year ago, this newest Haitian ISP emphasizes service for those who would otherwise be unserved. For example, Globelsud has vigorously promoted construction of telecenters where the public can use computers connected to the Internet. A customer can pay \$5 to spend a day in the telecenter exchanging email with relatives or friends living abroad. Frequent users of the telecenters pay up to \$50 per month for unlimited access.

Globelsud also focuses on providing rural Internet access—an important mission in a country where 65% of the population lives in rural areas. While its competitors offer services only in Port-au-Prince, Globelsud has been operating in five cities, including Port-au-Prince, an impressive accomplishment in any developing country and more so in Haiti, where 75% of the country's urban population is in Port-au-Prince. Globelsud aspires to serve even more secondary cities and rural areas in the future. Among its innovative projects is one that teaches seniors in a Haitian secondary school how to establish telecenters in rural areas.

To provide services cost-effectively, Globelsud is exploring various technologies, as well as different levels of service. So it often uses store-and-forward systems that exchange information over domestic phone lines every hour. This exchange is adequate for email or for downloading specific information, but a one-hour latency is not conducive to interactive Web browsing. Globelsud is also exploring innovative wireless technologies to bring Internet connections to remote areas more cost-effectively.

Future providers. Other Internet providers may be coming. For example, efforts are under way to establish a fifth commercial ISP. It would use phone lines as well as wireless connections, and would resell international capacity made available by ACN or Hintelfocus. Other providers that do not need telephone lines are likely to begin offering Internet services as well. The first will probably be the government's

National Bank (Banque de la Republique d'Haiti), which plans to deploy a fiber-optic backbone connecting to an international gateway. The primary goal would be to advance the country's financial infrastructure by supporting banks, insurance companies, stock brokerages, and other critical financial institutions. They would also serve universities and schools. Customers would pay fees for these services, despite the venture's not-for-profit status. What is probably most unusual about this state-owned Internet venture is that it is separate from the state-owned telephone company Téléco.

Meanwhile, if and when they begin operating, the providers of cellular telephone service will also be able to bypass Téléco to reach local customers—and could be motivated to become full-service ISPs or make resale agreements with ACN or Hintelfocus.

Protecting the Telephone Monopoly

Although Téléco has a monopoly on the lucrative international telephone services, other companies can carry international Internet traffic and form VPNs by connecting private LANs or private branch exchanges in Haiti with similar systems in other countries. An international carrier has no way of knowing when its customers are using its service to support voice communications that might otherwise have taken the form of long-distance phone calls. This issue has been so problematic in Haiti that allegations of the practice led to a severe reduction of the phone lines available to two of the ISPs—ACN and Companet.

This clash is common in many developing countries, although it is particularly severe in Haiti. Reasons for the severity include the government's heavy dependence on revenue from this government-owned telephone monopoly, its potential impending privatization, and the extremely high prices Téléco charges for international phone calls. Regardless of the Internet, Haiti will eventually have to decrease the price of international calls and probably increase domestic rates to balance the revenue shortfall. Such a move will probably be prompted by call-back services, which allow calls out of Haiti to be charged as if they were calls *into* Haiti. International regulatory pressure is also mounting.

Ironically, the government's effort to protect Téléco has probably harmed the company in the long term. In many countries, Internet growth increases revenues for the telephone company. Calls to ISPs can be extremely long, leading to significant new revenue in countries where the rate structure involves a per-minute charge for local calls, and especially in developing countries like Haiti, where long downloads of information from abroad are common. In addition, frequent Internet users often want to install additional phone lines. If Téléco were allowed to charge more for installing extra phone lines, it could generate the new revenue it needs to expand and improve its own infrastructure. However, Téléco's existing policy of rationing phone lines to Internet users has further encouraged the heaviest users and those most likely to want additional phone lines to bypass the phone company. This phenomenon could undermine Téléco's profitability.

Spectrum Management

Because of the country's lack of telephone lines, three of the four commercial ISPs rely primarily on wireless technology to reach their customers. Consequently, wireless communications are essential for Internet growth in Haiti. But how should access to the spectrum be regulated? Today, the government requires no license for access, and wireless devices can be placed anywhere, but ISPs have to pay significant fees to the government's regulatory authority. The rights and obligations of these unlicensed users are not entirely clear. This is already leading to controversy, with allegations that some unlicensed wireless connections interfere with a particular licensed microwave link and demands that those operating these Internet connections cease operation. Whether or not the allegations are true, the controversy demonstrates the value of clear spectrum-management policies where Internet growth is the goal.

Of the many options available for managing a spectrum band intended for Internet access [2], the traditional one is to require licenses for all transmitters, where license-holders gain exclusive access to a block of spectrum. Applicants for a license specify enough information about intended use of this block so a regulator can prevent excessive interference with existing license holders. Haiti's current unlicensed approach has the advantage that the regulatory authority does not add unnecessary delay to the process of Internet expansion; it also makes it possible for ISPs to offer dedicated links to mobile devices, as there is no need for permission from the regulator to move a transmitter from one site to another. Since Internet access is characterized by a large number of devices, each con-

suming a small fraction of available spectrum, removing the regulatory process in this manner is a tremendous benefit. One disadvantage of Haiti's unlicensed approach is that there is nothing to prevent many businesses from deploying transmitters in the same location, producing the constant risk of congestion. Luckily, in a country like Haiti, where spectrum utilization is low, this congestion is considerably less likely than it would be in a U.S. city, and Haitian ISPs have made good use of the opportunity. Another problem is that, since spectrum is shared, the people designing and deploying devices have little incentive to conserve spectrum, possibly leading to scenarios in which devices transmit constantly or at excessive power. Some telecommunications providers may even set up transmitters whose sole purpose is to interfere with the transmissions of their competitors. If the Haitian government continues the unlicensed approach, explicit rules of coexistence could be added to reduce many of these problems [3, 4].

International Gateways

Two of the current ISPs are allowed by the government to operate international gateways; the other two cannot, despite applications to the regulatory authority. Many developing countries permit only a single international gateway. The advantages of having more is apparent in Haiti; one ISP—ACN—with facilities for international communications, voluntarily chooses to provide communications services for some of its ISP competitors. If this facilities-based ISP, which then resells this capacity, along with other services, refused to do so, customers might be lost to the other facilities-based ISP—Hinfocus. The fact that the Haitian ISPs have different market niches makes the resale arrangement more attractive to potential facilities-based competitors. The existence of additional competitors is also good for Haiti, particularly when one of them has targeted customers who might otherwise be left out completely.

Although facilities-based providers can benefit from providing capacity to other ISPs that resell the capacity, it is often to the facilities-based ISPs' advantage to take customers from the resellers whenever they can. This inevitably causes tension; disputes may concern prices, quality of service, and access to equipment, IP addresses, and other limited resources. Some Haitian ISPs want the regulatory authority to intervene, but these matters are difficult to regulate effectively. Therefore, the tension will probably continue until the government grants more companies the right to operate an international gateway—even if they choose not to exercise that right.

The Government as Provider

The National Bank's decision to provide Internet services exemplifies another dilemma common in developing countries. It recognizes the need for such an Internet structure to strengthen the financial sector, and that no commercial ISP has access to the necessary capital. A government can even tap international donor organizations. However, such a move could threaten the commercial ISPs by siphoning off their customers, perhaps with the help of implicit subsidies. Making the enterprise effective and efficient under government control is also a challenge, as demonstrated by Téléco's experience. Perhaps this Internet infrastructure will also be privatized some day. It is too early to draw conclusions from the Haitian experience in this area.

Conclusions

The Haitian experience proves the Internet can grow even in the least developed countries—as long as government regulators grant commercial ISPs permission to operate and gain access to critical resources. More important, Haiti has shown that there are many paths to Internet development and that every country has to find the one that best matches its resources and objectives. The Internet began in the U.S., where roughly 95% of all homes had telephone lines, the lines were dependable and relatively free of noise, and prices were low relative to income. Thus, commercial ISPs in the U.S. relied primarily on dial-up service, and ISPs in many developing countries have emulated this approach. Haiti has not—with good reason, including the fact that it has no comparable telephone system. Resourceful Haitian ISPs have instead adopted wireless technologies as a critical part of Internet infrastructure, even though the wireless devices they use are clearly designed for other purposes. The ISPs consume a resource—unused spectrum—that is more plentiful in Haiti than in countries like the U.S. They have also demonstrated that low-speed, store-and-forward communications and telecenters have particular value in the Haitian context.

The importance of wireless technology to Internet growth makes spectrum management particularly important. Like people in all developing countries, Haitians have the opportunity to develop spectrum policies appropriate to their special circumstances, like greater availability of spectrum. Their current approach demonstrates the vast potential of unlicensed spectrum, as well as challenges to overcome if clear and effective coexistence rules are not established. Indeed, with appropriate policies, unlicensed spectrum may be even more valuable in developing

countries than it is in wealthier ones.

As in many developing countries, artificially high prices for international telephone service create particular difficulties for Internet growth, as Internet telephony threatens this revenue stream. The issue is further complicated by the growth of wireless alternatives. The artificially high prices encourage heavy users to bypass the telephone system; when international telephone rates are reduced, as they inevitably will be, telephone carriers will not be able to share to the same degree the increased revenue from Internet expansion. Thus, the presence of wireless Internet access provides additional incentive for government regulators to rebalance these rates.

Many developing countries allow only a single entity to operate an international gateway carrying commercial Internet traffic. Some government regulators point to economies of scale to justify this arrangement. Haiti has demonstrated the value of having two such gateways and of allowing resale. This situation prompted the emergence of the four ISPs, which collectively cover a broader range of customers. Still, the resale arrangements are not entirely without tension, because some ISPs offer both wholesale services to resellers and retail services to Internet customers, an arrangement that complicates matters. It is likely that further easing licensing restrictions on international gateways will reduce or eliminate these tensions. ■

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