**The state of the Internet in Cuba, January 2011**

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**Preface**

In the 1990s, during the years just before and just after Cuba’s first Internet connection, I visited the island three times, and wrote several reports and articles on the state of Cuban networking.   
  
Cuba was one of the leading pre-Internet networking nations in the Caribbean. The small community of Cuban networking technicians was like that of other nations at the time. They were smart, resourceful, and motivated. They believed, correctly, that the Internet was important -- that it would have a profound impact on individuals, organizations and society. They were members of the international community of Internet pioneers.  
  
This report is an update of my earlier reports, a study of the state of the Internet in Cuba today. I discovered that remarkably little has changed since those early days. The Cuban Internet has stagnated, while most of the world raced ahead. This left me saddened -- for the optimistic Internet pioneers who were not able to realize their dreams and for the Cuban people who have not enjoyed and profited from the Internet.   
  
I can think of three major causes for this stagnation: the US embargo, the Cuban economy, and the government's fear of information freedom.   
  
The US embargo delayed an undersea cable and made computers, routers, and other equipment expensive and difficult to obtain. Cuban leaders are quick to blame the embargo for their networking problems, but it was only one hurdle.  
  
With or without an embargo, building Internet infrastructure, training a generation of demanding users, building the Internet industry, and developing innovative applications is expensive. Cuba's first Internet connection occurred a few years after the fall of the Soviet Union, and the economy was severely depressed during that "special period." Furthermore, the policies of the Cuban government were hostile to, not encouraging of, foreign investment. Cuba could not afford to develop the Internet.  
  
The third constraint was the government's fear of freedom of speech and communication -- the dictator's dilemma. They were unwilling to risk political instability in order to achieve the benefits of the Internet.  
  
This sad situation is changing. Cuba will soon have an undersea cable. Chinese networking equipment and expertise are world class and, presumably, not effected by the embargo. The political situation in the United States is slowly changing as the revolution fades further into the past. The Cuban leaders are old and will change. Most important, there is a good deal of pent up demand for the Internet among the well-educated Cuban population. **The state of the Internet in Cuba**

We conducted several studies of Cuban networking in the 1990s, shortly before and again shortly after the transition from store and forward email and news groups to the Internet.[[1]](#endnote-1) The studies were organized around the six-dimension Mosaic Group framework for characterizing the state of the Internet in a nation.[[2]](#endnote-2) This report is an update of those studies, a survey of the state of the Cuban Internet today, using roughly the same framework. It is organized as follows:

* Pervasiveness
* Geographic dispersion
* Communication infrastructure – international, domestic and mobile
* The Chinese role in building Cuban communication infrastructure
* Organizational infrastructure
* The dictator’s dilemma
* Trained users – the Youth Computer Clubs
* Trained Internet technicians – university computer science
* Sectorial absorption and sophistication of use

**Pervasiveness**

In the pre-Internet days of twice a day email and network news, Cuba was among the leaders in Caribbean traffic and numbers of users, but the combined effect of the U. S. embargo, Cuban poverty and Cuban government’s fear that the Internet might erode political power and cultural values has crippled the Cuban network, leaving them behind nearly all Latin American and Caribbean nations today.

Appendix 1 shows Internet pervasiveness indicators from Latin America and the Caribbean, as self-reported to the International Telecommunication Union. Cuba is last in fixed broadband Internet subscribers and secure Internet servers.[[3]](#endnote-3) Only Belize, Bolivia, El Salvador, Haiti, Nicaragua and Surinam trail Cuba in Internet users per capita, and Cuba is far below the average for the region (Table 1).

|  |  |  |  |
| --- | --- | --- | --- |
|  | Fixed broadband Internet subscribers (per 100 people) | Internet users (per 100 people) | Secure Internet servers (per million people) |
| Cuba | 0.0 | 12.9 | 0.1 |
| Average | 7.2 | 29.2 | 172.7 |

Table 1, Selected Internet pervasiveness indicators.

It should be noted that these figures differ from a survey of 38,000 households conducted by Cuba’s National Statistics Office (ONE) in 2009.[[4]](#endnote-4) That survey found that only 2.9 percent of respondents had had direct access to the internet during the previous year.

Some of the discrepancy between the ONE survey and the figures reported to the ITU may be due to inconsistent terminology – it is not clear what “Internet user” means. An Internet user in Cuba or another developing nation is much different than an Internet user in the U. S. or another developed nation. Let us look closer at Cuban user characteristics, using the results of the ONE survey.

As shown in Table 2, the majority of the users surveyed (59.9%) accessed the Internet at school. Access from one’s own home or from another home, which may be a bed and breakfast hotel, accounts for another 21.5% and access at public places – Youth Computer Clubs (YCC) and post offices account for 7.4% as does access at work. (The majority of this public access is at YCCs. The post offices have only 299 computers in 54 locations while the YCCs have 8,626 computers in 607 locations).[[5]](#endnote-5)

|  |  |  |  |
| --- | --- | --- | --- |
| Location | Total | Men | Women |
| Home | 5.9 | 5.8 | 5.9 |
| Work | 7.4 | 6.8 | 7.9 |
| School | 59.9 | 59.1 | 60.8 |
| Another person’s home | 15.6 | 16,2 | 15.1 |
| Youth Computer Club | 5.4 | 5.4 | 5.3 |
| Post Office | 2.4 | 3.0 | 1.9 |
| Other | 3.4 | 3.7 | 3.1 |

Table 2, Internet access location (percent).

In a developed nation, people typically access the Internet from many fixed locations – home, work, school, WiFi hotspots, libraries, and so forth, and since the introduction of the Apple iPhone, mobile access has grown far faster than any previous Internet technology.[[6]](#endnote-6)

As we see in Table 3, Cubans who use the Internet do so infrequently. This is because Internet use is expensive and slow, making most network based applications and modern Web sites unusable.

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency | Total | Men | Women |
| At least once per day | 22.6 | 23.1 | 22.1 |
| At least once per week | 35.6 | 34.9 | 36.3 |
| At least once per month | 30.8 | 32.1 | 29.6 |
| Less than once per month | 11.0 | 9.9 | 12.0 |

Table 3, Internet access frequency (percent).

The survey also found that 5.8 percent of respondents had used email during the previous year, and, as we see in Table 4, email is used primarily at work. The rate of email use is twice that of Internet use in Cuba. Few users in a developed nation restrict their Internet access to email.

|  |  |  |  |
| --- | --- | --- | --- |
| Location | Total | Men | Women |
| A residence | 13.2 | 13.4 | 13.0 |
| Work | 68.0 | 65.2 | 70.4 |
| School | 11.0 | 12.6 | 9.6 |
| Hotel, Youth Club, etc. | 7.8 | 8.8 | 7.0 |

Table 4, Internet access frequency (percent).

Other recent data from the ONE gives further insight into the nature of Cuban Internet access. We see in Table 5 that people share computers.[[7]](#endnote-7)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
| Number of computers | 300 | 377 | 430 | 509 | 630 | 700 |
| Computers on the Internet | 193 | 243 | 258 | 330 | 400 | 455 |
| Internet users | 940 | 1,090 | 1,250 | 1,310 | 1,450 | 1,600 |
| Users per computer | 4.9 | 4.5 | 4.8 | 4.0 | 3.6 | 3.5 |

Table 5, Internet computers and users (thousands).

ONE reports that there are currently 3.5 users per Internet-connected computer, and the number of users is growing more rapidly than the number of Internet-connected computers (Figure 1).

Figure 1, Users sharing computers.

Content and activity filtering and surveillance also constitute a form of access limitation. Table 6 shows content and activity limitations at various types of access location as reported by an anonymous source.[[8]](#endnote-8)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Post Office | YCC | University | Work | Hotel | Home |
| Domestic email | Y | Y | Y | Y | Y | Y |
| International email | Y | N | Y | Y/N | Y | Y |
| Visit domestic Web pages | Y | Y | Y | Y | Y | Y |
| Visit international pages without restriction | N | N | N | N | N | N |
| Visit international pages with some blocked | Y | N | Y | Y | Y | Y |

Table 6, Permitted activity at various locations.

Our source reported that Cubans are now allowed Internet access in hotels if they are able to afford the time charges.

The AvilaLink “information management” program is widely deployed in locations where there are multiple computers.[[9]](#endnote-9) It can selectively filter Web sites and functions, monitor time for billing, and log activity for surveillance. In addition to being limited in access and application, a Cuban user is often aware that logs may be kept of the sites they visit and their communication may be monitored. This would be intimidating and restrict the user experience.

Access is also curtailed by cost, which, as we see below, is very high relative to Cuban income levels and international norms. If someone does not have access at work or school, they may be unable to afford it elsewhere, and, even if they do have access at school or work, they are restricted in what they are authorized to do online.

Finally, network speed severely limits Internet application. As we see below, the majority of Internet users have dial-up modems and international connectivity is limited to slow, low-capacity satellite links. Even if everyone in Cuba had a modern computer and access was unfettered and free, the outdated network would limit them to the sorts of applications we were running fifteen years ago.

In spite of the above limitations on Internet access and the possibility of surveillance, there is significant informal and technically illegal Internet use in Cuba. Ironically, the most sophisticated users of the Internet might be the globally visible Cuban blogging community which is often critical of the government, and users of websites like Revolico.com, a classified advertising website for Cubans, which is similar to Craigslist and hosted in Spain.[[10]](#endnote-10) Let us look more closely at the example of Revolico.

The Cuban government blocks access to Revolico, but motivated users circumvent the restriction. The Cuba Study Group considers Revolico to be “one of the best examples of uncensored information exchange between Cubans,” and estimates that they get 8,000 unique visits per day.[[11]](#endnote-11) Furthermore, many of the website’s users are willing to advertise technically illegal items like international email addresses, Internet usage time, and electronic devices that are only recently legal.

The Democracy Council has observed Revolico for nearly a year.[[12]](#endnote-12) At the time of their first snapshot, in early 2010, they found 3,000 email addresses of people advertising goods and services. They mined the site for email addresses every two weeks thereafter, discovering an average of 2,700 new addresses each month. While some users listed fictitious email addresses and supplied telephone numbers for actual contact. In eleven months, they accumulated approximately 30,000 unique, valid email addresses.

Revolico demonstrates the existence of a substantial community of informal Internet users who are not afraid to engage in black market activity, including the sale of illegal items, on a blocked site. These informal users are uncounted in government reports or the survey we described above.

To be an “Internet user” in Cuba is not the same as being an “Internet user” in a nation where people have their own (or several) computers with persistent, high-speed Internet connections. The difference is qualitative – the applications are different as is the impact of the Internet on individuals, organizations and society.

**Geographic Dispersion**

In 1998, we noted that Cuba's network, while very small and slow, was more geographically dispersed than those in many emerging nations.[[13]](#endnote-13),[[14]](#endnote-14) Two of Cuba's primary internal networks, Infomed (serving the health care community) and Tinored (serving the YCCs and NGOs), were spread throughout the island. Infomed was in every provincial capital and Tinored in nearly every municipality (approximately 160 locations). As sparse as Cuban connectivity was, it was relatively dispersed by the standards of developing nations at the time, as illustrated in Table 7, which summarized the situation in Africa at that time.

|  |  |
| --- | --- |
| Availability | Number of nations |
| No connectivity | 7 |
| Store-forward only | 3 |
| IP in capital only | 29 |
| IP in second city | 7 |
| IP nationwide (local dial up) | 8 |
| Total | 54 |

Table 7, African Connectivity, 1998.

Serving rural communities and areas outside of Havana remains a priority today, but progress is difficult given the state of the economy. Appendix 2 shows ICT indicators by province in 2007, and Figure 2 shows that Internet access is concentrated in Havana.

Figure 2, Internet concentration by province.

**International connectivity**

Cuba’s international connectivity is exclusively via satellite, and, as of January 2010, was reported to be 209 Mbps upstream and 379 down.[[15]](#endnote-15) This is very slow for an island with a population over 11 million. To put that in context, my university has 10,000 students and our Internet connection speed is 1 Gbps – one small university has a higher capacity link than the entire nation of Cuba because there are no fiber optic cables connecting the island to the Internet.

But a cable project is underway. An agreement to build an undersea cable between La Guaira, Venezuela and Siboney in the eastern province of Santiago de Cuba was announced in February 2007. The projected cable is labeled ALBA-1 in Figure 3.

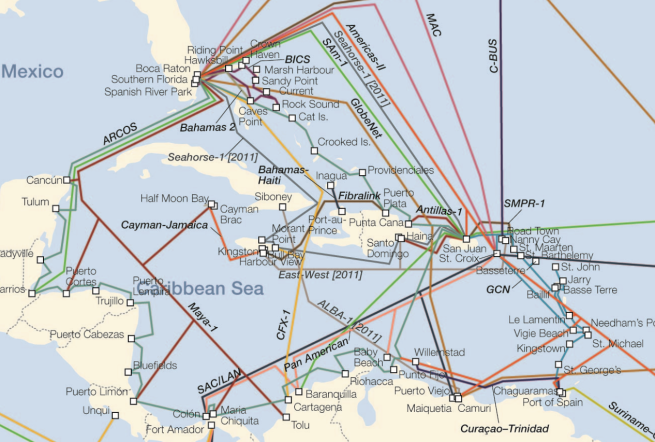


Figure 3, Caribbean undersea cables in the vicinity of Cuba.[[16]](#endnote-16)

The acronym ALBA refers to the eight-member Bolivarian Alliance for the Americas, established initially by Cuba and Venezuela.[[17]](#endnote-17) This cable is one of several ALBA projects, which are aimed at socialist cooperation and regional integration. The 1,550 kilometer, 640 GB/s cable was originally scheduled to be completed in early 2009 at an estimated cost of $63 million.[[18]](#endnote-18)

A joint venture made up of Alcatel-Lucent Shanghai Bell and Telecomunicaciones Gran Caribe (TGC) has been formed to install the cable. TGC is itself a joint venture between the Venezuelan and Cuban governments. It is 60% owned by state-run Telecom Venezuela and 40% by Cuban Transbit. The joint venture will not offer service over the cable, but will lease capacity to operators.

The cost estimate has risen to $70 million, but that includes a link from Cuba to Jamaica and a second phase might link Haiti and Nicaragua. Cable & Wireless has contracted with TGC to build the Jamaica-Cuba link. Venezuelan President Hugo Chávez is said to have received a $70 million loan from China for the project.[[19]](#endnote-19)

The installation was delayed several times, but exploration of the topography of the ocean floor and the physical design of the cable are now complete. Installation began in January 2011 and is expected to finish in July.[[20]](#endnote-20)

However, the state of complementary human and hardware infrastructure to land the cable and connect in Havana and other locations is unclear. One clue is that they plan to continue operating the current satellites, which implies that some organizations and networks will not be connected to the cable. Improved speed and efficiency for currently connected institutions seems to more the goal than widespread access.[[21]](#endnote-21) The telephone network should also be able to use the cable.

As we saw in Figure 3, many cables come close to Cuba, and connecting to one of them would be much cheaper than to ALBA-1, but U. S. and Cuban policies have kept that from happening. We know that the U. S. embargo has prohibited an undersea cable from Florida to Cuba, but, if such a cable had been licensed, it is not clear that Cuban officials would have cooperated.

US regulations were recently modified to encourage communication links with Cuba,[[22]](#endnote-22) and a year ago, TeleCuba Communications, Inc. was granted a license to install a 110 mile undersea cable between Key West, Florida and Havana, Cuba costing an estimated $18 million.[[23]](#endnote-23) However, TeleCuba would not be allowed to ship equipment used to terminate the cable or to extend it from the landing point to other locations within the island because that equipment would be viewed as contributing to Cuba’s domestic economy.[[24]](#endnote-24) The Cuba Study Group and others have urged the relaxation of these US constraints.[[25]](#endnote-25)

ALBA-1 is scheduled for completion in July 2011, but without interface equipment and a network that provides access to the cable, it will be meaningless. Without proper planning, complementary human and physical infrastructure, and a government willing to allow access, the cable will be a strong link in a very weak chain. The satellite bottleneck is only one factor in explaining restrictions on Internet access and extremely high prices in Cuba. When the cable is finally in place and properly complemented, it will be interesting to see how it impacts Internet pricing and government access policy.

**Domestic connectivity infrastructure**

In 1998, we noted that Cuba's relatively new IP infrastructure was limited in speed and scope, but, reflecting Cuban values, it was more widely dispersed than those in many emerging nations and it was non-commercial. [[26]](#endnote-26) [[27]](#endnote-27) Today’s network remains widely dispersed, non-commercial and slow.

Table 8 shows ping times from the U. S. to three Cuban hosts during the evening. If we assume that 250 or 300 milliseconds are due to satellite link latency, these times are still very slow. [[28]](#endnote-28) These speeds would make low-bandwidth, asynchronous applications like email frustrating and browsing a modern Web site nearly impossible. More research is needed to explain these long times and to look for possible transport algorithm improvement.[[29]](#endnote-29)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Mean | Minimum | Maximum | St. dev. |
| [www.jovenclub.cu](http://www.jovenclub.cu) | 634 | 632 | 642 | 2.2 |
| osri.gov.cu | 856 | 707 | 995 | 89.9 |
| scu.sld.cu | 667 | 638 | 885 | 59.9 |

Table 8, Ping times from the US.

We discovered Cuban (.cu) hosts that were physically located in the United States, Spain, Venezuela and Canada. Foreign location allows rapid access by those outside of Cuba, but access is slower from within the Island.

The internal access network is also apparently very slow. Cuba reported having 2,000 broadband Internet connections and 1,450,000 Internet users in 2008.[[30]](#endnote-30) Taking these suspiciously round numbers at face value indicates that Cuba relies almost exclusively on dial-up modems for “last mile” access, which would make for a frustrating experience for Cuban users, and helps explain the fact that Cuban Web sites are very limited in function and content – “Web 1.0.”

All of this raises two questions – why has the domestic infrastructure stagnated and what are the implications for improvement after the Venezuelan cable is installed?

The official Cuban stance is to blame the situation on the U. S. Embargo, which has made it difficult for them to attract foreign investment and kept them from connecting to nearby undersea cables. They often quote the fact that a Miami-Cancun cable runs only 32 kilometers off the coast and speculate that a high speed connection to it would cost less than a million dollars.

Until recent years, they could have argued that the embargo restricted Cuban access to network infrastructure equipment manufactured in the US, thus blocking its purchase or raising prices. However, the emergence of the Chinese as major manufacturers of networking equipment has diminished the importance of the embargo in this area. The Chinese can supply Cuba with modern, competitively priced wireless and cabled equipment and have significant experience in the construction of networks domestically and in developing nations.[[31]](#endnote-31)

However, the embargo is only one factor in determining the state of Cuban communication infrastructure. The impoverished economy and Cuban political decisions also play important roles.

Cuba was hard hit by the fall of the Soviet Union. That, not the U. S. embargo, which dated back to 1960, triggered the economic hardship of the “special period” during the 1990s. At the time of their IP connection, Cuba had few funds for telecommunication infrastructure. They sought foreign investment and Telecom Italia obtained 27% ownership of ETECSA; however, the focus was on upgrading the telephone system at that time.

Poverty continues to limit the possibility for improving the domestic communication infrastructure. This was made clear in a recently released memo summarizing a discussion at the U. S. Interests Section in Havana among the commercial and economic counselors from six of Cuba’s seven largest trading partners, including China, Spain, Canada, the U.S., Brazil and Italy, plus key creditors France and Japan in February, 2010.[[32]](#endnote-32) These countries also represent most of the foreign companies investing in Cuba, with the notable exception of Venezuelan state-owned enterprises.

The diplomats noted that Cuba has been hard hit by the global financial crisis. Imports fell by 37% in 2009 and trade with China was off by nearly a billion dollars. Even food imports have fallen. Tourism and foreign remittances, sources of hard currency, are also down with the global downturn.

The creditor nations reported restructuring of debt and missed payments. The Cuban government insists upon majority ownership of any enterprise and even proposals for micro-credit programs require the Council of State’s approval. To date, only one small Spanish micro-credit project has been approved. The diplomats also worried about Cuba's dependence upon an increasingly unstable Venezuela.

They did not foresee major economic policy change, but did admit to the possibility of limited reform to open private sector activities, and that did come to pass. However, their opinion was that leadership of the Cuban economy is becoming more centralized and that the military will continue to expand its influence in core economic activities.[[33]](#endnote-33) Overall, the diplomats were pessimistic, stating that the financial situation could become fatal within 2-3 years. Italy suggested Cuba could become insolvent as early as 2011.

If the embargo was lifted and the Venezuelan cable landed tomorrow, the economic situation would stop major domestic communication infrastructure improvement.

Furthermore, if Cuba could afford to improve their infrastructure, they would still be constrained by fear that the Internet would be politically and culturally destabilizing.

While there is some degree of access or content control in every nation, those with relatively free political systems tend to be more open. Dictatorial governments seek to control access to political information. At the same time, they recognize that the Internet can be a source of economic productivity and improved health care, education, and quality of life. This presents a "dictator's dilemma" -- the desire to have the benefits of the Internet without the threat of political instability. How do you give people access to information for health care, education, and commerce while blocking political information?

Prior to 1995, Cuba was among the leaders in Caribbean information and communication technology. When the political leaders became aware of the Internet, they became concerned. Raul Castro attributed the fall of the Soviet Union to openness and feared non-governmental organizations, which were beginning to use the Internet.

Cuba slowed the diffusion of the Internet around 1995 while they decided whether to proceed, and, if they would proceed, who would be in charge.[[34]](#endnote-34) They decided to use the Internet, but maintain control over access by the means outlined in the prior section. Since access was to be limited, there was no need to invest heavily in domestic infrastructure.

**Mobile infrastructure**

Cuba’s wired infrastructure is limited in scope and what infrastructure exists is appropriate for the early days of the Internet. The same is true for wireless access. Cuba’s mobile network is limited in coverage and it is “second generation” technology, suited to voice conversation and text messaging, but not Internet applications.

As shown in Figure 4, coverage is concentrated in cities. We also see that cable connectivity reaches only to Cielo de Avila.

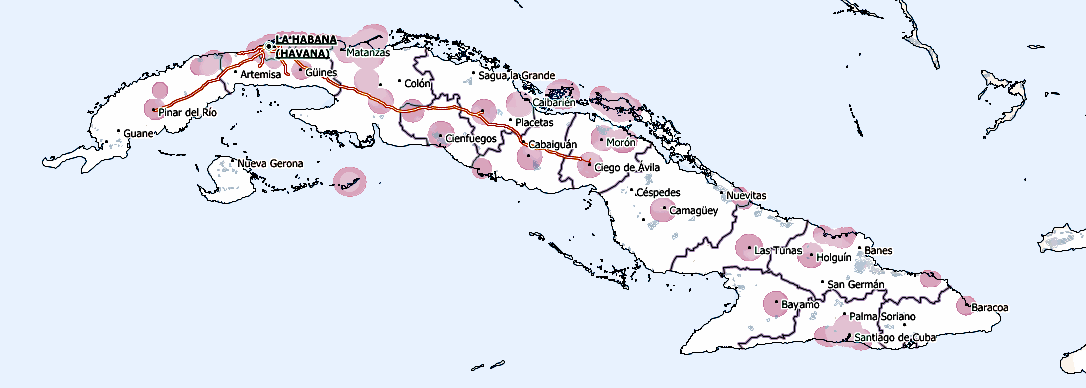
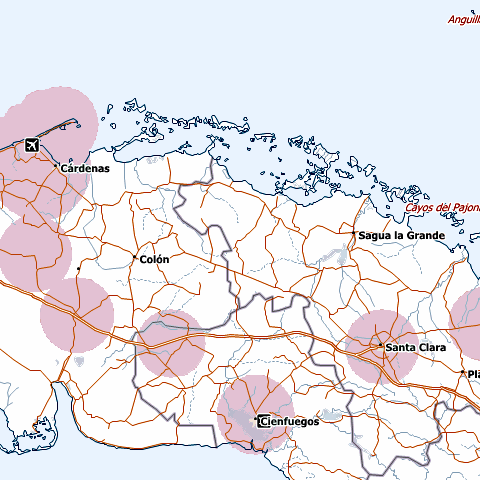
 

Figure 4, Cuban mobile coverage with detail east of Havana.[[35]](#endnote-35)

Cubans are able to make phone calls and send and receive short SMS text messages, but they are not able to send and receive messages with images or video. More important, they do not have access to the third-generation Internet applications used on the Apple iPhone and the Android phones.

While it is far from ubiquitous outside of Cuba, an estimated 940 million people will have mobile Internet access as of 2010 (Table 9).

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | (millions) | | | | | | Per 100 inhabitants | | | | | |
|  | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
| Developed | 57 | 132 | 253 | 352 | 505 | 631 | 4.6 | 10.8 | 20.7 | 28.7 | 41 | 51.1 |
| Developing | 16 | 27 | 54 | 105 | 198 | 309 | 0.3 | 0.5 | 1 | 1.9 | 3.5 | 5.4 |
| World | 73 | 159 | 307 | 458 | 703 | 940 | 1.1 | 2.4 | 4.6 | 6.8 | 10.3 | 13.6 |

Table 9, Mobile broadband subscribers in developed and developing nations.[[36]](#endnote-36)

Cuba’s limited service is extremely expensive. For example, between 7 AM and 10:59 PM, making or receiving a local call costs CUC$.45 per minute.[[37]](#endnote-37) Making an international call is CUC$1.83 to the US, CUC$1.40 to Venezuela, CUC$1.60 to the Americas, and CUC$1.80 to the rest of the world. Receiving international calls is free. Data is no cheaper than voice. Receiving an SMS message is free, but sending a domestic message is CUC$.16 and an international message is CUC$1.00. Internet data connections are possible, but they are very slow and expensive. For US$50 per month one receives only 100 daytime and 50 evening and weekend minutes. Bear in mind that Cuban gross national income per capita was $5,550 in 2008.[[38]](#endnote-38)

At these rates, it is not surprising that few Cubans are mobile subscribers. As we see in Appendix 3, Cuba has only 3 subscribers per 100 capita, while the average among upper middle income nations in the region is 93.4. Of the 229 nations that have reported on cellular subscribers during the last decade, only North Korea, Myanmar, Kiribati, the Marshal Islands, Eritrea, and Ethiopia have fewer cellular subscribers per capita than Cuba.[[39]](#endnote-39)

Cuba is one “generation” behind in mobile access, and the fourth generation is already rolling out. 180 operators in 70 countries are currently investing in fourth generation LTE equipment, which will enable them to serve more users at higher speed. It is estimated that at least 64 of these networks will be in commercial service by the end of 2012, and another 52 are in pre-commitment trials.[[40]](#endnote-40)

**The Chinese role in Cuban infrastructure**

Telecom Italia owns 27% of ETECSA, the incumbent Cuban telephone company, mobile operator and Internet service provider, but they are trying to sell their share.[[41]](#endnote-41) At the same time, we saw that China is said to be financing the ALBA-1 cable through Venezuela, and Shanghai Bell is a partner in the joint venture installing it. Furthermore, Alcatel-Lucent, another partner, has a history of doing projects with Huawei and it was rumored last year that Huawei might purchase a share of Alcatel-Lucent.[[42]](#endnote-42) More recently, Alcatel-Lucent announced a €1.18 billion agreement to install wireless networks in China during a visit to France by the Chinese president, Hu Jintao. There are clearly close connections between Alcatel-Lucent and China. It should also be noted that both Huawei Submarine Networks and Alcatel-Lucent Submarine Networks have the capability to install undersea cables.

Figure 5 shows the ceremony commemorating 50 years of Cuba-China relations. Cuba was the first Latin American nation to establish diplomatic relations with China in 1960, and at the ceremony the Chinese pledged to "provide assistance to Cuba to help its social and economic development."[[43]](#endnote-43)



Figure 5, Ceremony commemorating 50 years of Cuba-China relations.

As of January 2008, China was Cuba's second largest trading partner and the largest importer of Cuban goods, especially nickel and sugar. Trade with China doubled between 2005 and 2006 and grew by 23 percent in 2007 to $2.3 billion.[[44]](#endnote-44) China also loans Cuba money to purchase their goods. The last time I was there, it seemed that everyone in Havana was riding Chinese bicycles and there were many Chinese busses. The government also distributes energy efficient Chinese appliances like refrigerators and stoves on credit.

However, the recent global recession has put pressure on the relationship. The leaked memo mentioned above states that in 2009, trade with China was down by nearly $1 billion, and the Chinese diplomat at the meeting admitted having problems getting paid on time and complained about Cuban requests to extend credit from one to four years.[[45]](#endnote-45) He also complained of Cuba’s insistence on retaining controlling interest in joint ventures, with “visible exasperation,” and said that any discussions around Chinese-style reforms, particularly regarding foreign investment, had been difficult and “a real headache.”

The future of China-Cuba trade may be foreshadowed by the Chinese experience in Africa, as reported by Michel and Beuret, who describe the rapid increase of Chinese involvement in virtually every African nation:[[46]](#endnote-46) China is involved in the ALBA-1 cable, and Cuba will need a domestic backbone and other infrastructure if it is to utilize the cable well. China has experience building domestic communication infrastructure in developing nations, including their own, and Huawei is a leading manufacturer of both wireless and wired IP communication equipment. What will be the role of the Chinese in building out Cuba’s telecommunication infrastructure? Has China already been working on cables and other infrastructure within Cuba? Further research is needed to answer questions like these.

**Organizational infrastructure**

Organizational infrastructure refers to the government organizations, Internet service providers, and professional and trade organizations that regulate, invest in and deliver access to the Internet.

The first networking organization in Cuba was CENIAI, the National Center of Automated Data Exchange, which began networking in 1982 with connections to Soviet and European databases and very limited email. In 1992, CENIAI was offering asynchronous email and Usenet News. At that time CENIAI had 62 staff members, and was part of the Ministry of Science, Technology and Environment.[[47]](#endnote-47) By 1995, Cuba was among the networking leaders in the Caribbean. CENIAI and three other networks with international UUCP links were transferring over 60 Mbytes of international email and had nearly 2,600 users (Table 10}. [[48]](#endnote-48)

|  |  |  |  |
| --- | --- | --- | --- |
| Network | k bytes | Accounts | Users |
| TinoRed | 16,709 | 413 | Youth Computer Clubs and NGOs |
| CENIAI | 16,481 | 732 | Several organizations |
| Infomed | 14,000 | 500 | National System of Health Information |
| CIGBnet | 13,441 | 950 | Center for Genetic Engineering and Biotechnology |
| Total | 60,631 | 2,595 |  |

Table 10, Monthly international email traffic in 1995.

CENIAI established their first persistent, 64 kbps Internet Protocol link in September 1996 (Appendix 4). They were very proud and happy to be on the Internet, but the Internet was no longer under the radar. There was debate over the pros and cons and how to exploit and control it and also who would control it, and those favoring control over access prevailed

In June, 1996, the Executive Committee of the Cuban Council of Ministers issued Decree 209 regulating the use and development of information networks and Internet services within Cuba.[[49]](#endnote-49) The decree established an inter-ministerial commission with responsibility for all matters relating to access from the Republic of Cuba, the information in the computer networks of global reach. The commission was to be chaired by the Minister of Metallurgical Industry and Electronics and include Ministries of Science, Technology and Environment, Communications, Interior, Revolutionary Armed Forces and Justice. Many interests were represented.

It appears that power was consolidated in January 2000, when Decree Law 204 created the current Ministry of Informatics and Communications (MIC) with control over Information technology, the electronics industry, telecommunications, broadcasting, radio spectrum and the postal service – traditional media and computer networks.

The MIC is responsible for computerization of society, control and supervision, legislative framework, and ICT security.[[50]](#endnote-50) User and technician training are included within computerization of society mission. The Ministry also certifies radio equipment and license data networks (including WiFi LANs). They are also responsible for legislation and policy for all media, including the Internet, and for computer security. (However, their Web site lists only one security organization, Segurmática, makers of anti-virus software).

The MIC Web site lists key strategic goals for 2012, which gives us some insight into their priorities:

* Obtaining external long and medium term credit to finance capital investments and short term credit for current trade
* Forming economic partnerships with foreigners to provide capital, technology and marketing distribution in selected areas.
* Flexible handling of the global finance system to ensure good terms without undermining the National Economy.
* Strengthening and expansion of strategic partnership with China and other countries that are sources of technology and political-economic integration in the framework of ALBA.
* Ranking and assuring projects financially using the cyclic MIC system of research-production-marketing-technical services.
* Strengthening university and technological education related to the IC sector and post-graduate training on the MIC system.
* Fostering an atmosphere conducive to the development of ethical values and prevention of transgressions.
* Developing work and salary systems that encourage high productivity.
* Reorganizing based on the MIC strategy.

It is noteworthy that the first five have to do with global finance and foreign partnerships, with China singled out as a strategic partner. One is focused on technology education and another on financial and job incentives to increase productivity. This is reminiscent Deng Xiaoping's “radical pragmatism” during the 1980s, when China greatly expanded direct foreign investment and substituted the slogan "getting rich is glorious" for "from each according to his ability, to each according to his needs.”

The character of the Web site is also indicative of their level of sophistication and the values of the Ministry. It is definitely “Web 1.0” with little information and no interaction. It is a poorly designed online brochure.

Drilling down, we discover that one must apply to establish a WiFi network (Appendix 5). Rather than apply online, one is expected to print out a Word form and fill it in. The form also contains what is probably an inadvertent technical error in that it refers to the 2456 – 2482 MHz frequency band, whereas the standard low frequency WiFi band is 2412-2484 MHz.[[51]](#endnote-51) They do not even mention the 5GHz WiFi band – that may be an oversight or it may be illegal.

The fact that one is required to apply to set up a WiFi network is startling. The success of WiFi in other nations was due to its being an open standard in a license free spectrum band. The industry has thrived and WiFi has become an important part of our communication infrastructure because one can walk into a store, buy a low cost access point, and set it up at home or work. In Cuba it seems that one must fill in a form stating the make and model of every WiFi access point.

One could conclude that this micro management is a draconian attempt to control access and freedom, but I think it is more likely a reflection of a sort of “bureaucratic Alzheimer’s disease.” It is reminiscent of Cuba’s recent decision to privatize 500,000 government jobs, in which they spell out the 178 permitted occupations -- babysitting, shoe shinning, clothes washing, etc.[[52]](#endnote-52) Regardless of the explanation, it is discouraging.

The appointment of Ramiro Valdés Menendez as Minister of Informatics and Communications on August 31 2006 also provides information about the organization. Valdés was born in 1932 and fought in the Cuban Revolution. He has held high office, including Minister of the Interior and the head of Copextel, which assembles and imports electronic equipment.[[53]](#endnote-53) He also has close ties with Venezuela, chairing a committee on that countries electricity crisis.[[54]](#endnote-54)

Valdés is generally painted as an Internet hard liner, based on quotes from a speech at the 2007 Informatica Conference:[[55]](#endnote-55)

These technologies constitute one of the tools for global extermination, as despite the known risks that they incur, they are also necessary to continue to advance down the path of development….The wild horse of the new technologies could and must be controlled, and Info-communications must be used to serve peace and development.

A good portion of the talk is politically correct attack on the US, blaming the blockade for the sorry state of the Cuban Internet, claiming that the US, along with Google, Microsoft and Bill Gates, is at cyber war with Cuba, conducting Internet surveillance and blocking access to Cuban material. He says the U. S. used the *still mysterious* 9/11 attack as a pretext for its cyber war (my italics). He also holds the rich nations, led by the US, for the existence and attempted cover up of the digital divide.

These quotes form only a small bit of anecdotal evidence, but they, along with his age, background in the revolution and the Interior Ministry, indicate that the Internet will remain relatively closed as long as he remains in power.[[56]](#endnote-56)

Valdés made other points which may be telling. He stated that the Cuban Internet will not be financed and centered on consumerism, but will give priority to socially valuable applications in health, education, culture and science, and that they will invest substantially in technology infrastructure and human capital. It remains to be seen if they can afford to and do make those investments and whether they can find a way to finance the development of the Internet without commercialization.[[57]](#endnote-57)

We do not know what the recent replacement of Valdés as MIC minister foreshadows.[[58]](#endnote-58) The new minister, Medardo Díaz Toledo, had previously been head of the communications division of the Armed Forces Ministry (The Ministry of the Revolutionary Armed Forces). Valdés is now the vice president over the MIC and the ministries of Basic Industry and Construction. Medardo Diaz is younger than Valdés, and was trained as a communication engineer. Perhaps this reflects a decision to modernize the Internet and other communication infrastructure within Cuba or it may be an expansion of Valdés’ power and an endorsement of the status quo. It could also be an indication that the role of the armed forces is expanding. We really have no idea at this point, but it future developments are worth watching.

**The Dictator’s Dilemma**

In the early days of the Internet, we assumed that free access to this many-to-many medium would lead to a flowering of transparency and citizen journalism, which would inevitably lead to enhanced democracy. This view was bolstered by what was perhaps the first example of Internet citizen journalism during the 1991 Soviet coup attempt, when all Russian media except Usenet news groups were shut down by the authorities.[[59]](#endnote-59) [[60]](#endnote-60) [[61]](#endnote-61)

This led to our simplified notion of what we called the “dictator's dilemma.”[[62]](#endnote-62) The Internet would become critical infrastructure in economic development and improving quality of life, but would tend to undermine the government and change the culture. That assumption still has supporters, but it has also been challenged. Let’s look at the Cuban view of the dictator’s dilemma at the time the Internet was just being established

As long as Cuban data networking consisted only of asynchronous UUCP connectivity and connectivity to Soviet information via X.25 links, it remained under the radar, and a small community of networking technicians and supporters formed. But, when faced with the possibility of connection to the incipient Internet, which was growing rapidly and allowed for persistent IP connectivity, networking came under scrutiny. The positions of two leaders, Carlos Lage and Raul Castro, exemplify the debate at that time.

At the Fifth Plenum of the Central Committee of the Communist Party of Cuba in 1997, Carlos Lage, Secretary of the Executive Council of Ministers, spoke of the growing importance of computer-based communications, pointing out that "one telex can cost twelve dollars [whereas] the same message costs 75 cents in the form of a fax and 3 cents via the Internet," and he expressed confidence that "in spite of our blockaded circumstances, we are in a relatively good position [to face the challenges of such scientific and technological changes], due to the educational and scientific work developed by the revolution."

Raul Castro was aware NGOs were seen as potentially subversive. In March, 1996 he stated:

[T]he enemy does not conceal its intention to use some of the so-called non-governmental organizations (NGOs) established in Cuba in recent times, as a Trojan horse to foment division and subversion here, and the theoretical cover they give them is to present them as members of civil society ...There are also many NGOs throughout the world that are not enemies of the people; many of them encourage solidarity with Cuba, respecting its independence, its national identity and its socialist path. ... But we would be extremely stupid if we pretended not to see the manipulation that is being carried out through other supposed NGOs whose only aim is to enslave our country once again and turn it into something akin to an even more dependent Puerto Rico.

In the same speech he refers to the Soviet experience with NGOs, citing his reading of an analysis by Gillian Gunn:

Glasnost gave rise to a proliferation of Soviet NGOs, and the Moscow press stated in 1988 that some 40,000 clubs and associations had been set up. The close ties between Havana and Moscow at that time exposed Cuban intellectuals to many of these groups, which supported such things as religious freedom, popular culture, environmental protection and socioeconomic reform.

Castro continued, speaking of press freedom in general, stating that "The glasnost which undermined the USSR and other socialist countries consisted in handing over the mass media, one by one, to the enemies of socialism." It is noteworthy that these remarks were presented at the same Plenum as Carlos Lage's call for increased use of networks.

Castro and others were also acutely aware of section 209 of the Helms-Burton act, which authorizes the President "to furnish assistance and provide other support for individuals and independent non-governmental organizations to support democracy-building efforts for Cuba," and provides for "not less than $5,000,000 of the voluntary contributions of the United States to the Organization of American States solely for the purposes of the special fund."

Castro and his allies evidently won the debate.[[63]](#endnote-63) The Internet was to be controlled. The remaining question was who would control it. In retrospect, I suspect that the ensuing power struggles and bureaucracy did more to stunt the growth of the Cuban Internet than fear of political and cultural instability.

With 20-20 hindsight, we have a more nuanced view of the dictator’s dilemma today. This is due in no small part to the experience of the Chinese, who are now working with the Cubans. How might we qualify our early, naïve concept of the dictator’s dilemma?

For one thing, it has become clear that the Internet can be used by dictators as well as democrats, as Secretary of State Clinton pointed out in a speech on Chinese control of the Internet.[[64]](#endnote-64)

Amid this unprecedented surge in connectivity, we must also recognize that these technologies are not an unmitigated blessing. These tools are also being exploited to undermine human progress and political rights. Just as steel can be used to build hospitals or machine guns, or nuclear power can either energize a city or destroy it, modern information networks and the technologies they support can be harnessed for good or for ill. The same networks that help organize movements for freedom also enable al-Qaida to spew hatred and incite violence against the innocent. And technologies with the potential to open up access to government and promote transparency can also be hijacked by governments to crush dissent and deny human rights.

There are numerous examples of terrorists and governments using the Internet for ill. For example, the Al-Aqsa Martyrs' Brigades militants use Google Earth to prepare their attacks (Figure 6).

****

Figure 6, Al-Aqsa uses Google Earth to plan missile launches.

Internet surveillance is also common.[[65]](#endnote-65) Shane and Lehren report that Wikileaks has disclosed an American Embassy cable from Beijing showing that China’s Politburo directed the intrusion into Google’s computer systems, and that the Google hacking was part of a coordinated campaign of computer sabotage carried out by government operatives, private security experts and Internet outlaws recruited by the Chinese government. Cables said they have broken into American government computers and those of Western allies, the Dalai Lama and American businesses since 2002.[[66]](#endnote-66)

As mentioned above, the Cuban government has not closed classified advertising sites even though illegal goods and services are sometimes advertised there, but that is not to say they are not watching them carefully. The same may be said of the flowering of the Cuban cultural and political blogosphere. There is a thriving, often anti-government blogging community.[[67]](#endnote-67) The blogs are often available in both English and Spanish, so they are accessible to those in and out of Cuba, and probably under government surveillance.

Why does the government let these activities continue? They may consider them a source of intelligence, providing a window into the informal Internet community and its activity. The government may realize that classified sites provide a valuable service and improve the efficiency of the economy and the quality of life. If the black market would go on with or without them, the impact of shutting them down would be marginal. They may fear potential public reaction to a crackdown. We suspect that Cuban bloggers and users of classified advertising sites are on the average relatively young, innovative and technically skillful, and perhaps therefore valued by the regime more than they are feared. We can only speculate.

In addition to actively using the Internet and conducting Internet surveillance, virtually all governments ban the publication of material they deem culturally or politically unsuitable, and dictatorships commonly attempt to block access to material published by others.

Other critics of the dictator’s dilemma hypothesis question the efficacy of the Internet as a force for democracy. Take the widely publicized role of Twitter during the protests following the 2009 Iranian election. Did Twitter make a difference? Supporters such as Huffington[[68]](#endnote-68), Stone[[69]](#endnote-69), and Shirky[[70]](#endnote-70) answer "yes" in discussing the role and importance of Twitter during the protests. They also go beyond Iran, citing other examples of the impact of the use of Twitter and other Internet services in support of democracy and transparency.

However, writers like Gladwell[[71]](#endnote-71) and Efrandiari[[72]](#endnote-72) offer a more conservative view of the power of the Internet. Efrandiari points out that a year after the widely publicized use of Twitter during the Iranian election protests, Mahmoud Ahmadinejad remained firmly in power and that many of those using Twitter during the protests were in fact outside Iran. Gladwell contrasts the use of the Internet with the civil rights struggle in the United States, arguing that the Net does not provide hierarchical organization or the sustained commitment in the face of risk that is necessary to bring about change.

But, perhaps the most effective governor of the democratizing influence of the Internet is indifference. University of Cambridge foreign policy expert, Stefan Halper states that “given a choice between market democracy and its freedoms and market authoritarianism and its high growth, stability, improved living standards, and limits on expression -- a majority of the developing world and many middle-sized non Western powers prefer the authoritarian model.”[[73]](#endnote-73)

As James Fallows[[74]](#endnote-74) points out, the "great firewall" of China blocks content using four basic techniques:

* remove domain name from the DNS
* block specified IP addresses
* block URLs with suspicious words in them
* scan a returned document and block it if banned words are found (creating unpredictability since one document from a site may be blocked while other passes)

These are all rather easily defeated using a proxy server or VPN, email may be encrypted using a specialized service or a secure link to a Web based email service like https://mail.google.com/, and voice communication using Skype is also encrypted. But, most Chinese users are not willing to put up with the inconvenience, response delay, and possible risk of discovery to bother with such measures.

Many are not even motivated to do so. A 2007 survey found that over 80% of respondents think the internet should be managed or controlled (for pornography and other culturally sensitive material as well as politics), and almost 85% say they think the government should be responsible for doing it.[[75]](#endnote-75) Today's Chinese are free by their historical standards, and they have many sources of information other than the Internet. Compared to a developed nation, relatively few Chinese are Internet users, and many of those who are, are doing well so support the government.

At the end of the day, the conservatives prevailed at the time the Cuban Internet was born. They opted for a small Internet effort with tight control over content and access. Of course perceived political threat was not the only factor. The U. S. embargo eliminated the possibility for an undersea cable link to Cuba, forcing them to depend upon relatively slow and expensive satellite links to the outside world. Furthermore, Cuban economy had been hard hit by the dissolution of the Soviet Union and the loss of Warsaw Pact trade. They would have had a difficult financing investment in the Internet regardless of their assessment of the risks and benefits.

**User training, the Youth Computer Clubs**

Trained, demanding user are a key component of widely disbursed internet running sophisticated applications, and the Youth Computer Clubs (YCCs) are a uniquely Cuban training organization.

Thirty two YCCs were established in 1987. At that time, there was no Internet connectivity, but the clubs offered computer games and classes on productivity software and programming. In 2009, there were 607 YCCs, 138 outside of main towns and 39 in mountainous regions.[[76]](#endnote-76)[[77]](#endnote-77) The YCCs had 3,208 teachers and 8,626 computers, and had produced 2.25 million course graduates since their founding.[[78]](#endnote-78)

The emphasis on the YCCs was attested to by the fact that they were given a large, well-maintained building, which had been the Sears department store in Havana prior to the revolution, as their headquarters. Fidel Castro spoke at the headquarters opening and the walls feature pictures of that event and a framed note saying "I envy you" on the wall (Figure 7).[[79]](#endnote-79)

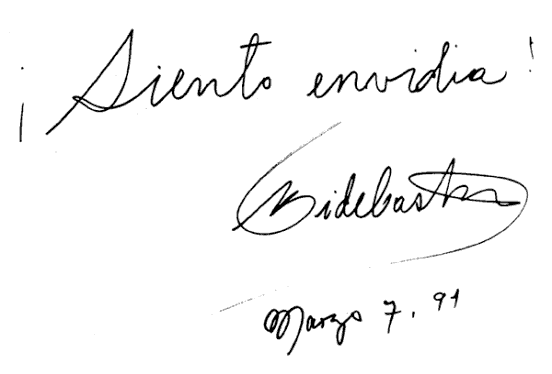
****

Figure 7, Fidel Castro’s autograph at the dedication of YCC headquarters.

Training is the primary function of the YCCs. They offer classes aimed at users on Windows, Linux, Microsoft Office, Adobe Photoshop, Web design, introductory programming, etc. Each club has its own schedule of classes and offerings[[80]](#endnote-80)

The YCC offerings are reminiscent of a U. S. junior college five to ten years ago – an IT literacy curriculum that we have characterized as “second generation.”[[81]](#endnote-81) We distintuish that from the current third genreation, which focuses on the Internet rather than the PC as a platform for developing and delivering applications. An Internet-based, third generation curriculum is not feasible at the YCCs because of their slow or non-existent connectivity.

The YCCs have a central Web site,[[82]](#endnote-82) and fourteen of the provincial YCCs have their own Web sites.[[83]](#endnote-83) These all adbere to the same general format, although the content is not uniform. The central site is typical in that it has links to image and video collections, an online library (literature), software downloads, discussion forums, FAQs, links to the YCC magazine, etc.

A few anecdotal observations arose while skimming several YCC Web sites. The central site has links to perhaps fifty or one hundred books and roughly the same number of software downloads. This is a sad reminder of Cuba’s disconnection from the world, where we take access to millions of online books, programs and Internet services for granted. The YCC Web sites are reminiscent of those of the early 1990s. I discovered only one Web service – a site for sending electronic postcards.[[84]](#endnote-84) The simplicity of this offering – with just a handful of still images -- stands in stark contrast to the varied and sophisticated video greeting cards that are commonplace on the Interent today.

**Internet technicians – university computer science**

University education is valuable both for developing trained demanding users and a community of qualified Internet application and networking technicians and the results are encouraging. Cuba has a 100 percent literacy rate and, as we see in Appendix 6, their tertiary education expenditure and enrollment rates are the highest among the Latin American and Caribbean nations classified by the World Bank as upper-middle income. As shown in Table 11, Cuba is well above average for those nations.[[85]](#endnote-85)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Expenditure per student (% of GDP per capita) | Enrollment (% gross) | Enrollment, female (% gross) | Enrollment, male (% gross) |
| Cuba | 58.8 | 121.5 | 153.7 | 91.2 |
| Average of others | 25.5 | 39.2 | 46.2 | 32.4 |

Table 11, Selected tertiary education indicators.

General university education should be a predictor of wide adoption and use of the Internet when it becomes available and computer science education can give us some idea of the availability of future technicians. Cuba has 17 universities and 25 professional and technical schools offering specialization in information and communication technology.[[86]](#endnote-86)

The newest and most prominent of these is the specialized University of Informatics Science (UCI). UCI was founded in 2002 with 300 teachers and 2008 students, and by 2007 had over 10,000 students. Roughly half of the students are women, and they have opened regional faculties in the provinces of Havana, Granma and Ciego de Avila, but 73 percent of the planned 2010/11 class comes from the city of Havana which has only 21% of the Cuban population.[[87]](#endnote-87)

The UCI curriculum mixes coursework with practical experience – the goals are to educate professionals in the computer science filed and to produce software and informatics services.[[88]](#endnote-88) They offer studies in three areas, undergraduate and graduate computer science and technology-based education. By U. S. standards, the university Web site has very little detailed information. There are no details on the graduate and teaching technology programs, just one page descriptions. The courses included in the undergraduate curriculum are listed, but none of the material one would expect to find on a U. S. university Web site -- course descriptions, syllabi, notes, etc. is provided.

The five-year, ten-semester undergraduate curriculum is summarized in Table 12.[[89]](#endnote-89) I have categorized 18 of the classes as “computer science.” I compared this with the undergraduate computer science curriculum at my university,[[90]](#endnote-90) a typical state college, and Carnegie Mellon,[[91]](#endnote-91) a leading research university. Both require 14 computer science courses for a BS. No course descriptions were given for UCI, but I suspect that the Cuban courses, like those at my university, are less rigorous and theoretical than those at Carnegie Mellon. Carnegie Mellon also offers a wide array of computer science electives, while my university and UCI constrain the options.

|  |  |  |
| --- | --- | --- |
| CS | Topic | Semesters |
| C | Programming | 3 |
| C | Telecommunication | 2 |
| C | Software engineering | 2 |
| C | Computer architecture | 2 |
| C | Database Systems | 1 |
| C | Operating Systems | 1 |
| C | Computer Graphics | 1 |
| C | History of Computing | 1 |
| C | Computer Ethics | 1 |
| C | Artificial Intelligence | 1 |
| C | Computer Security | 1 |
| C | Management information systems | 1 |
| C | Electronic commerce | 1 |
|  | Professional Practice | 10 |
|  | Physical education | 10 |
|  | Mathematics | 8 |
|  | Foreign language | 5 |
|  | Economics, history, philosophy | 5 |
|  | Business, accounting and finance | 3 |
|  | Physics | 2 |
|  | Defense Preparedness | 1 |
|  | Social problems of ICT | 1 |
|  | Research Methodology | 1 |
|  | Teacher Training | 1 |

Table 12, UCI undergraduate computer science curriculum.

The curricula diverge more widely when we go beyond the computer science courses. The Cuban students spend time on foreign language (English), physical education and professional practice, which are absent from the U. S. curricula, and they also take a little more math than their U. S. counterparts. U. S. students have a wider assortment of humanities and social science electives to choose from.

The work-study balance – ten semesters of professional practice and three studying business topics – differentiates UCI from the U. S. universities. Students are expected to work on useful applications in education, health, sport, online government, writing software and building Web portals and developing multimedia products.

This practical experience is a significant and valuable part of their education; however, in many cases they will be learning technology that is outdated in many nations. We have gone through roughly four generations of platform for developing and delivering IT applications – batch processing, timesharing, personal computer, and the Internet. Cuba remains largely in the third, personal computer, generation while the rest of the world is increasingly using the Internet as a platform for developing and delivering applications. This impacts both user sophistication and expectations and the skills being taught to technologists. Cuba will fall even further behind current practice as the world moves to the mobile Internet as an application delivery platform. They are just now rolling out last generation mobile technology.

Cuban students are expected to produce value while they learn, but their education is free. By way of contrast, tuition at Carnegie Mellon, a private university, is $41,500 per year and my California state university charges out of state students $10,170 per year and in state students $3,377 per year.

The Cuban model, stressing practical experience and paying for one’s education by working, has the potential for being pedagogically effective and it is also economically egalitarian. Of course the actual results would depend upon the quality of the classroom education and the ability to find practical projects that were both pedagogically efficient and valuable to the society. Well educated students should also be able to move from second to third and fourth generation tools if and when the Internet is modernized.

**Sectorial absorption and sophistication of use**

The Mosaic framework considers the degree to which the Internet is being applied in the education, health, government, and commercial sectors and the sophistication of that application – the degree to which it introduces novelty, altering individual’s lives, organizations and society. Based on informal, anecdotal Web surfing, we found the general level of sophistication of applications to be low. This is a result of Cuba’s non-commercial values and the state of their Internet infrastructure.

By Cuban standards, the health sector is relatively strong. As noted above, Infomed, the health care network, had connections in every provincial capital in 1998. Today, there is Internet access in clinics, hospitals and institutes throughout the nation (Table 13). However, as noted above, this access is typically to a shared computer. There are over 31 Infomed users per computer with Internet access.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Total | Clinics | Hospitals | Institutes |
| Health centers | 730 | 498 | 219 | 13 |
| Number of computers | 12,684 | 8,796 | 3,264 | 624 |
| In fundamental activities | 12,684 | 8,796 | 3,264 | 624 |
| With Internet access | 4,291 | 2,600 | 1,236 | 455 |
| In information projects | 12,684 | 8,796 | 3,264 | 624 |
| Number of workers who use computers | 133,705 | 74,505 | 53,000 | 6,200 |
| With Internet access | 131,805 | 74,505 | 53,000 | 4,300 |
| Access from home | 58,920 | 30,400 | 24,900 | 3,620 |

Table 13, Use of information and communication technology in the health sector, 2009.[[92]](#endnote-92)

By Cuban standards, the Infomed Web site is well done and has a lot of content. It is a portal with blog and links to a wide variety of medical literature and statistics. There are also links to significant portals for 50 diseases and specialties. The Informed Web site is atypically open. For example, there are links to Pub Med and the Public Library of Science. Most Cuban Web sites are in Cuban content silos.

The Infomed site and sub-portals are attractive, well-organized, content-rich Web 1.0 sites. I did not see things like Web services, application programming interfaces, collaborative projects and databases, rich media, AJAX user interfaces, etc. that we expect today. This is not a reflection on the Infomed staff – the site is appropriate for the Cuban Internet.

Cuban schools are poorly equipped. Table 12 shows the number of Internet-connected computers in schools at various levels. (Unfortunately, we were unable to find data for universities).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Pre and primary | Secondary | Technical and professional | Pre-university vocational | University |
| Number of centers | 8,215 | 1,006 | 479 | 414 | 65 |
| Specialization in ICT | - | - | 25 | - | 17 |
| Number of computers | 30,838 | 16,361 | 14,389 | 12,186 | 41,890 |
| With Internet access | 1,559 | 3,060 | 7,796 | 2,000 | - |

Table 14, Table 12, Use of information and communication technology in education, 2009.[[93]](#endnote-93)

In 2008, the World Bank reported that Cuba had 871,444 primary and 637,177 secondary pupils, or 559 and 208 students per computer.[[94]](#endnote-94) Those contention ratios indicate that faculty and staff use the Internet in school, not students. As noted above, the YCCs also offer classes, but the majority of those are on stand-alone applications using stand-alone computers.

We also noted that university Web sites present less content than would a typical university in a developed nation. We have come to expect online catalogs and, grades and grade reporting, course descriptions, syllabi, course notes, online lectures, faculty research and publications, experimental and production Web services, etc. on university Web sites, and they are not to be found in Cuba.

We found government Web sites even less informative than those of the universities. The Web site of the Ministry of Information and Communication, which one would expect to be exemplary, is an example. As mentioned above, it consists of blog-type news and announcements along with links to what are by and large short, static Web pages devoted to describing the mission of some portion of the ministry, bragging about achievement, and clarifying bureaucratic hierarchy and relationships. The top level links are:

* Computerization of society
* Control and supervision
* Legislative framework
* ICT security

Again, we saw none of the e-government applications and technologies we take for granted in developed or some developing nations.[[95]](#endnote-95) There are also a number of broken or incomplete links.

The MIC server was slower than some others in Cuba. We pinged it 25 times and found an average of 1,344 milliseconds, with a minimum of 1,220 and a maximum of 1,344. Later in the day (during the evening in Havana) it had improved to an average of 633 milliseconds, with a minimum of 628 and a maximum of 654.

The Ministry runs another site on the computerization of society.[[96]](#endnote-96) This site has archives of a newsletter that was last published in 2006. There is also a searchable database of Cuban Web sites, which seemed promising at first. A search for sites dealing with information and communication technology turned up 88 sites, but many of the links were broken, others were aliases, leading to the same site, and at least one was an ecommerce site selling Cuban consumer goods (The store in your home).

To make matters worse, the links were displayed on a background of error warning messages (Figure 8).

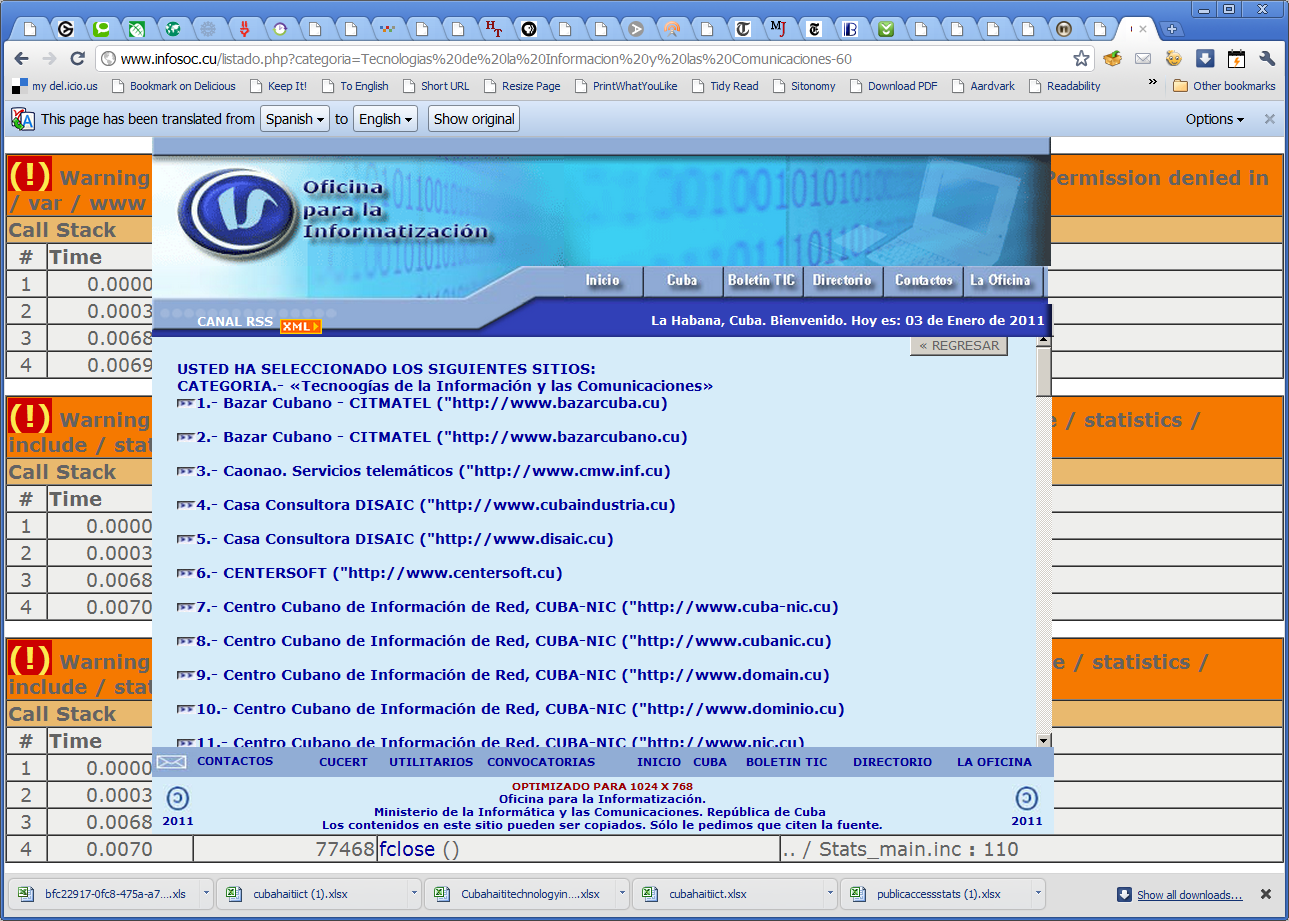


Figure 8, List of sites with error messages in the background.

This may be an extreme example, but like many other Cuban Web sites, it has the feeling of a time warp -- an unfinished undergraduate HTML/PHP project done around 1996, replete with error messages, broken links and a “cool” script displaying the current date.

Another anomaly on many government Web sites is a notice of copyright at the bottom of each page. It is surprising to see concern for copyright in a communist nation, particularly on a government site. The MIC Web gives permission to copy the material as long as the source is cited, but does not link to Creative Commons. In fact, we did not find any links to Creative Commons licenses on Cuban sites we visited, and take this as an indication of ignorance of mainstream developments in the wider Internet community.

We have singled out the MIC site because it should demonstrate Cuba's best practice, but, in reality there is no reason for it to. E-government is geared toward improved transparency and processing transactions and providing other government services. Transparency is intended to make democracy more efficient, but Cuba is not a democratic state, and the provision of services and transaction processing requires pervasive access to the Internet, which is also absent in Cuba.

As we saw above, Cuba has fewer secure Web servers per capita than any nation in Latin America or the Caribbean. Secure Web servers are a proxy for commercial application, and it is not surprising that e-commerce is not a priority in a poor, communist nation. In line with the goals and achievements of the revolution, health and education seem to take priority. Outside of tourism, we found only a little consumer-oriented electronic commerce and no business-oriented electronic commerce.

Sectorial absorption and sophistication of use are low by the standards of any developed nation. The current state of application and sophistication of use is not far removed from that of the days of their first Internet connectivity. Cuban Web sites are “Web 1.0” and have therefore not had a strong impact on the government or commerce. The impact of the Internet upon Cuban education and health care has been greater, but it is far less than it would be if Cuba had the international connectivity and domestic infrastructure of a moderately developed nation. Ironically, the most sophisticated users of the Internet might be the globally visible Cuban blogging community, which is often critical of the government.

**Conclusion**

Cuba established their first persistent IP connection to the Internet in September 1996. That was a little more than five years after the National Science Foundation changed its acceptable use policy[[97]](#endnote-97) to allow commercial use of the Internet. Internet data was primarily text, programs and some images.[[98]](#endnote-98) The Web was new and consisted of static pages. The Request for Comments documenting HTTP, the standard used for the Web, had just been published in May 1996.

At the time of their connection to the Internet, Cuba was not far behind the mainstream. The Cuban Internet lagged in speed and pervasiveness, but was close to developed nations in application sophistication. We were all using the Internet in the same ways -- sending text and an occasional image via email or list servers, posting text documents on Gopher servers, discussing issues in text-based news groups, transferring program and data files between computers and logging on to command-line interfaces on remote hosts.

Furthermore, the early technical community in Cuba had the same enthusiasm for and confidence in the importance of the emerging Internet as their colleagues in the rest of the world. They attended conferences and workshops and were full citizens of the early, global Internet culture. They knew the Internet would change the lives of individuals, organizations and society. But they were not able to participate in those changes, and that is sad for them, for Cuba and for the rest of the world.

During the ensuing 15 years, the Internet exploded while Cuba stood still. The Cuban Internet was frozen in time by the U. S. embargo, the dictator’s dilemma, and the Cuban economy.

Figure 9 shows the dramatic growth in Web hosts since 1995, and as dramatic as the spread of the Web has been, changes in applications, types and quantity of data and hardware and software technology have been even more important in widening the gap between Cuba and the rest of the world.

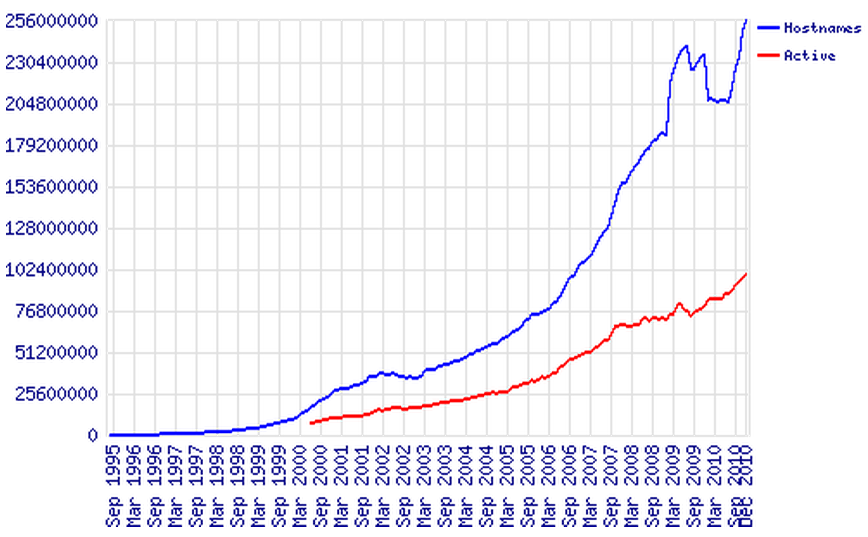


Figure 9, Web host growth, August 1995 - December 2010.[[99]](#endnote-99)

The BIT-L newsletter serves as an example.[[100]](#endnote-100) Years before Cuba was connected to the Internet, Jorge Espresate X. started a newsletter on developments in computing. The newsletter contained brief descriptions of the week’s articles, and was distributed via a list server. One retrieved an article by emailing a GET command with the article ID number to the server, which then emailed a return copy of the article. That was common practice at the time. The list is operating the same way today.

BIT-L was an email-based blog long before there were Web-based blogs. Had he been in the US, there is no doubt that Espresate would have been an early tech blogger, and he might well have gone on to become a podcaster, video podcaster, and head of an Internet broadcast network like TWIT.TV. It is sad that Cubans have stood by while we have been able to use and build upon the Internet.

But, this is not the end of the story. There is a great deal of pent up demand for Internet infrastructure and application in Cuba, along with a healthy, well educated population. The Castro government has been in power since 1959 and the displaced Cubans in Florida, New Jersey and the rest of the United States are aging. At some point, change in Cuban and U. S. policy will lead to a more open economy and favorable environment for investment and trade. When that time comes, we expect technology leapfrogging and rapid expansion of the Cuban Internet.

We will benefit along with Cubans when that happens. They will not only use the Internet they will bring their values and culture to it. The keynote speaker at the opening plenary session of the Info '97 Conference in Havana was Osvaldo Bebelagua, a Cuban information technology leader, who opened his address with a poem urging innovation and concluding that “on a young path, no traveler is old.” [[101]](#endnote-101) He went on to speak of hopes and fears for a networked society, stressing his concern that the Internet may lead to increased gaps between rich and poor nations and people within nations. His talk was followed by chamber music. Who knows what technology and applications might follow from such concerns?

Appendix 1. Internet pervasiveness indicators from Latin America and the Caribbean. [[102]](#endnote-102)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Fixed broadband Internet subscribers (per 100 people) | Internet users (per 100 people) | Secure Internet servers (per 1 million people) |
| Antigua and Barbuda | 14.5 | 75.0 | 646.4 |
| Argentina | 8.0 | 28.1 | 19.7 |
| Aruba | 17.4 | 22.8 | 356.7 |
| Bahamas, The | 10.1 | 31.5 | 263.4 |
| Barbados | 64.8 | 73.7 | 312.7 |
| Belize | 2.4 | 10.6 | 306.1 |
| Bolivia | 0.7 | 10.8 | 4.0 |
| Brazil | 5.3 | 37.5 | 25.9 |
| Cayman Islands | .. | 42.4 | 1,364.1 |
| Chile | 8.5 | 32.5 | 39.1 |
| Colombia | 4.2 | 38.5 | 12.1 |
| Costa Rica | 2.4 | 32.3 | 98.3 |
| Cuba | 0.0 | 12.9 | 0.1 |
| Dominica | 14.1 | 37.6 | 203.8 |
| Dominican Republic | 2.3 | 21.6 | 14.2 |
| Ecuador | 0.3 | 28.8 | 12.0 |
| El Salvador | 2.0 | 10.6 | 11.8 |
| Grenada | 9.8 | 23.2 | 57.7 |
| Guatemala | 0.6 | 14.3 | 8.8 |
| Guyana | 0.3 | 26.9 | 7.9 |
| Haiti | 0.0 | 10.1 | 0.8 |
| Honduras | 0.0 | 13.1 | 7.1 |
| Jamaica | 3.6 | 57.3 | 35.6 |
| Mexico | 7.1 | 22.2 | 17.2 |
| Netherlands Antilles | .. | .. | 706.8 |
| Nicaragua | 0.6 | 3.3 | 6.3 |
| Panama | 5.8 | 27.5 | 85.7 |
| Paraguay | 1.4 | 14.3 | 5.7 |
| Peru | 2.5 | 24.7 | 10.5 |
| Puerto Rico | 5.4 | 25.3 | 61.5 |
| St. Kitts and Nevis | 22.6 | 32.5 | 1,199.4 |
| St. Lucia | 9.1 | 58.8 | 87.2 |
| St. Vincent & the Grenadines | 8.6 | 60.5 | 100.7 |
| Suriname | 1.1 | 9.7 | 19.2 |
| Trinidad and Tobago | 4.6 | 17.0 | 46.3 |
| Turks and Caicos Islands | .. | .. | .. |
| Uruguay | 7.3 | 40.2 | 35.6 |
| Venezuela, RB | 4.8 | 25.7 | 7.4 |
| Virgin Islands (U.S.) | .. | 27.3 | 364.2 |
| Average | 7.2 | 29.2 | 172.7 |

Appendix 2, Internet access rates and other ICT indicators by province in 2007.[[103]](#endnote-103)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Province | Radio | TV | Telephone | Mobile phone | PC | Internet |
| PR | 5.6 | 6.5 | 5.1 | 2.7 | 4.3 | 3.6 |
| HB | 6.7 | 7.1 | 4.3 | 1.9 | 5.1 | 2.2 |
| CH | 23.8 | 22.1 | 39.1 | 71.1 | 55.2 | 57 |
| MT | 6.1 | 6.6 | 5.7 | 4 | 4 | 4.5 |
| VC | 7.7 | 7.6 | 8 | 3.1 | 4.8 | 2.1 |
| CF | 3.7 | 3.6 | 3.1 | 0.7 | 1.9 | 3.9 |
| SS | 4.4 | 4.3 | 3 | 3 | 2 | 2.1 |
| CA | 3.5 | 3.6 | 3.7 | 2.9 | 1.9 | 2.5 |
| CM | 7.3 | 7.1 | 7.2 | 2.1 | 4.9 | 10 |
| LT | 4.2 | 4.4 | 3 | 0.4 | 2 | 1.7 |
| HG | 7.6 | 8.2 | 4.8 | 2.3 | 3.9 | 1.1 |
| GR | 6.1 | 6.2 | 3.5 | 2 | 2.5 | 3 |
| SC | 8.4 | 8.1 | 5.9 | 2.1 | 4.6 | 5.5 |
| GT | 4.1 | 3.7 | 2.7 | 0.6 | 2 | 0.9 |
| IJ | 0.8 | 0.8 | 0.9 | 1 | 0.9 | 0 |

Appendix 3, Mobile phone subscribers per 100 capita in upper middle income Central American and Caribbean nations, 2008.

|  |  |
| --- | --- |
| Cuba | 3.0 |
| Costa Rica | 41.7 |
| Grenada | 58.0 |
| Mexico | 70.8 |
| Dominican Republic | 72.4 |
| Peru | 72.7 |
| Brazil | 78.5 |
| Suriname | 80.8 |
| Chile | 88.1 |
| Colombia | 91.9 |
| Venezuela, RB | 97.0 |
| St. Lucia | 99.6 |
| Jamaica | 101.3 |
| Uruguay | 105.2 |
| Panama | 115.2 |
| Argentina | 116.6 |
| St. Vincent and the Grenadines | 119.2 |
| Dominica | 136.6 |
| Antigua and Barbuda | 157.7 |
| St. Kitts and Nevis | 162.6 |
| Average | 93.4 |

Appendix 4, Email announcing Cuba’s first Internet connection. [[104]](#endnote-104)

From: Director CENIAI/ Jesus Martinez/IDICT <jemar@ceniai.inf.cu>

To: enredo@conicit.ve

CC: jemar@amauta.rcp.net.pe

Date: Mon, 9 Sep 1996 20:22:41 -0300 (EDT)

Queridos amigos;

Despues de tantos dias, annos, de sacrificio y desvelo, tengo la gran

satisfacion de comunicarles que nuestra querida Cuba, nuestro caiman

antillano ha podido ser conectada a INTERNET como habiamos deseado.

La conexion a 64 Kbps por el momento, se realiza a Sprint en E.U.

Muchos son los amigos que nos han ayudado, apoyado y seria injusto el

mencionar a alguien sin correr el riesgo de olvidar algun nombre, creo que

para ser honesto mi mayor reconocimiento lo voy a dirigir al FORO DE REDES

LATINOAMERICANAS Y DEL CARIBE,desde Rio hasta Lima. El FORO que nos dio la

oportunidad de conocernos, de compartir estrategias, de dimensionar

nuestras tareas, de proyectar mejor nuestras misiones y nos ensenno que

lograr conectarse a Internet no se hace solo con la tecnica, tambien se

hace con solidaridad.

Nuestro mayor agradecimiento a mi joven colectivo de CENIAI, que ha

confiado plenamente en nosotros y que ha sabido concretar este hecho

historico.

Una nueva etapa acaba de comenzar para nosotros, pronto comenzaran ha

conocer de nuestros WWW y de nuestros servicios de valor agregado, de

nuestra realidad y de lo mucho que podemos ayudar al desarrollo de

nuestra region y de nuestra cultura.

Un saludo bien Caribenno.

Jesus

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Jesus Martinez Alfonso

Director CENIAI IDICT

E-mail: jemar@ceniai.cu Ministery of Science,

Tel. (537)626565, 620757 Technology and Environment.

Fax. (537)338237

Electronic mail and Information Network

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Appendix 5, Application for a WiFi access point.[[105]](#endnote-105)

AGENCIA DE CONTROL Y SUPERVISIÓN -MIC

Dirección de Redes y Servicios de Infocomunicaciones

Ave. Independencia y 19 de Mayo, Plaza de la Revolución, Ciudad de La Habana, Cuba

Teléfono: (537) 66-8364 Fax: (537) 57-4110 Correo- E: [montero@mic.cu](mailto:monterof@mic.cu)

# FORMULARIO PARA LA SOLICITUD DE SISTEMAS INALÁMBRICOS PARA REDES DE ÁREA LOCAL (RLAN) EN LA BANDA DE FRECUENCIAS DE 2456 – 2482 MHz

1. Entidad: (nombre, dirección y organismo al que pertenece
2. Nombre y cargo de la persona acreditada según la Res. 23/00
3. Teléfono, Fax, Correo Electrónico
4. Datos del equipamiento

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DENOMINACIÓN DEL EQUIPO | MARCA | MODELO | CANTIDAD | OTROS |
| (Punto de Acceso, Enrutador, Adaptador de Estación, etc.) |  |  |  |  |

1. El equipamiento del sistema será suministrado por:
2. Lugares de ubicación de las estaciones en la red (INCLUYENDO ESQUEMA)
3. Expresar si la instalación es de carácter temporal, Permanente o una ampliación
4. La red donde serán instalados estos equipos está autorizada por el Ministerio de la Informática y las Comunicaciones, con el expediente número **XXX**
5. Firma de la persona acreditada:
6. Fecha:

***NOTAS:***

* El cliente debe obtener la autorización de compra de ACS antes de adquirir los equipos.
* Si la red no está autorizada, deberá solicitar formulario para la autorización o renovación de la misma en la ACS según Resolución No. 23/00 del Ministerio de la Informática y las Comunicaciones.
* Esta solicitud debe ser tramitada por la persona acreditada ante el MIC como representante de la entidad, según lo establecido en la Resolución 23/00 de este organismo.
* Los usuarios directos, que importan sus propias redes y sistemas deberán someter los equipos al Proceso de Homologación establecido en la Resolución 5/00 del MIC.

Appendix 6, Education indicators for Latin American and Caribbean nations classified by the World Bank as upper-middle income.[[106]](#endnote-106) [[107]](#endnote-107)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Expenditure per student (% of GDP per capita) | Enrollment (% gross) | Enrollment, female (% gross) | Enrollment, male (% gross) |
| Cuba | 58.8 | 121.5 | 153.7 | 91.2 |
| Argentina | 15.6 | 67.7 | 82.0 | 53.9 |
| Brazil | 30.4 | 34.4 | 38.9 | 30.1 |
| Chile | 11.5 | 52.1 | 52.3 | 51.9 |
| Colombia | 26.0 | 35.4 | 35.2 | 35.5 |
| Costa Rica | 35.9 | 25.3 | 28.3 | 22.5 |
| Dominican Republic | .. | 33.3 | 40.8 | 25.7 |
| Jamaica | 42.4 | 24.2 | 33.4 | 15.1 |
| Mexico | 37.1 | 27.2 | 26.9 | 27.5 |
| Panama | 26.5 | 45.0 | 55.6 | 34.9 |
| Peru | 10.9 | 34.5 | 35.5 | 33.4 |
| St. Lucia | .. | 14.8 | 20.4 | 9.1 |
| Suriname | .. | 12.3 | 15.6 | 9.2 |
| Uruguay | 18.1 | 64.3 | 82.2 | 46.9 |
| Venezuela | .. | 78.6 | 99.3 | 58.6 |

1. For links to reports on that work, see <http://som.csudh.edu/fac/lpress/cubabiblio.htm>. [↑](#endnote-ref-1)
2. For the Mosaic Group see: <http://mosaic.unomaha.edu/>. For an article outlining the analysis framework, using Cuba as an example, see: Larry Press, Grey Burkhart, Will Foster, Seymour Goodman, Peter Wolcott, and Jon Woodard, An Internet Diffusion Framework, Communications of the ACM, Vol. 41, No. 10, pp 21-26, October, 1998, <http://som.csudh.edu/fac/lpress/articles/acmfwk/acmfrwk.htm>. [↑](#endnote-ref-2)
3. Secure Internet servers are an indicator of commercial activity, which is nearly non-existent in Cuba. [↑](#endnote-ref-3)
4. Dirección de Turismo, Comercio y Servicios de Cuba, Tecnologias de la Información y las Communicaciones Uso y Acceso en Cuba, Septiembre 2010, <http://www.one.cu/publicaciones/06turismoycomercio/TIC/2009%20TIC%20Uso%20y%20Acceso%20en%20Cuba.pdf>. [↑](#endnote-ref-4)
5. ANUARIO ESTADÍSTICO DE CUBA 2009, Oficina Nacional de Estadisticas, 2010, <http://www.one.cu/aec2009/esp/17_tabla_cuadro.htm>. [↑](#endnote-ref-5)
6. Meeker, Mary, Scott Devitt and Liang Wu Ten Questions Internet Execs Should Ask & Answer, Web 2.0 Summit, San Francisco, CA, November 16, 2010, <http://www.morganstanley.com/institutional/techresearch/pdfs/tenquestions_web2.pdf>. [↑](#endnote-ref-6)
7. ANUARIO ESTADÍSTICO DE CUBA 2009, Oficina Nacional de Estadisticas, 2010, <http://www.one.cu/aec2009/esp/17_tabla_cuadro.htm>. [↑](#endnote-ref-7)
8. This table was completed by a single, anonymous correspondent in Cuba, and should be treated as anecdotal. Further research is needed. [↑](#endnote-ref-8)
9. <http://www.desoft.cu/Productos1/AvilaLink/tabid/431/Default.aspx>. [↑](#endnote-ref-9)
10. For a description of Revolico (www.revolico.com), its history, the Cuban black market and anecdotes about users, see Tim Elfrink and Vanessa Grisalez, Cuba's black market moves online with Revolico.com, Miami Times, Oct 1 2009,http://www.miaminewtimes.com/2009-10-01/news/cuba-s-craigslist-the-island-s-black-market-moves-online-with-revolico-com/. Two other sites, dicuba.com (hosted in Spain) and cu.clasificados.st (registered in Sao Tome & Principe and hosted in the Netherlands), also host Cuban classified ads. [↑](#endnote-ref-10)
11. Cuba Study Group, Empowering the Cuban People through Technology: Recommendations for Private and Public Sector Leaders, July 2010,

    http://www.cubastudygroup.org/index.cfm/files/serve?File\_id=eb8afce7-3b97-422d-9433-8935ee69e8a2. [↑](#endnote-ref-11)
12. The Democracy Council in partnership with Internews, Cuba’s Information Technology Opening: A Roadmap for Cyber Diplomacy Engagement and Open Internet Access, January 2011, http://www.democracycouncil.org/xxx. [↑](#endnote-ref-12)
13. Press, L., We Shape our Tools and they Shape Us (A Cuban Example), OnTheInternet, Vol. 4, No. 2, March/April, 1998, pp. 38-39, http://bpastudio.csudh.edu/fac/lpress/articles/cubanoti.doc. [↑](#endnote-ref-13)
14. The same held true for Cuba's telephone infrastructure. At the time of the revolution, 73% of Cuban main lines were in Havana, and today that figure is 45%. The Cuban revolution was against Havana, not from Havana, and equality is a primary social goal. [↑](#endnote-ref-14)
15. Aumenta la capacidad de conexión de la Internet cubana, afirma viceministro, Cubadebate, January 2010, http://www.cubadebate.cu/noticias/2010/01/07/aumenta-la-capacidad-de-conexion-de-la-internet-cubana/. [↑](#endnote-ref-15)
16. http://www.telegeography.com/product-info/map\_cable/downloads/2010\_0629\_CableMap\_TeleGeography.jpg.zip. [↑](#endnote-ref-16)
17. <http://en.wikipedia.org/wiki/Bolivarian_Alternative_for_the_America>. [↑](#endnote-ref-17)
18. <http://www.granma.cu/espanol/2007/febrero/vier16/8telecom.html>. [↑](#endnote-ref-18)
19. # Business News Americas, Undersea fiber optic cable due to be operational in 2010 - Cuba, Venezuela, June 10 2008, <http://member.bnamericas.com/news/telecommunications/Undersea_fiber_optic_cable_due_to_be_operational_in_2010>.

    [↑](#endnote-ref-19)
20. BBC News, Venezuela-Cuba undersea cable link work starts, January 22, 2011, http://www.bbc.co.uk/news/world-latin-america-12260410. [↑](#endnote-ref-20)
21. José Antonio Torres, El Cable Submarino Desafío en favor de la integración, Granma, November 3, 2010, <http://www.granma.cu/espanol/cuba/3noviem-desafio.html>. [↑](#endnote-ref-21)
22. <http://www.treas.gov/press/releases/tg273.htm> [↑](#endnote-ref-22)
23. <http://havanajournal.com/forums/viewthread/1347/>. [↑](#endnote-ref-23)
24. Wiltel applied for a license to build a cable from Florida to Cuba in the mid 1990s, but was unsuccessful, Press, L., "Cuban Computer Networks and their Determinants," DRR-1814-OSD (49 pages), RAND Corporation, Santa Monica, CA, February, 1998. [↑](#endnote-ref-24)
25. Cuba Study Group, Empowering the Cuban People through Technology: Recommendations for Private and Public Sector Leaders, July 2010,

    <http://www.cubastudygroup.org/index.cfm/files/serve?File_id=eb8afce7-3b97-422d-9433-8935ee69e8a2>. [↑](#endnote-ref-25)
26. Press, L., We Shape our Tools and they Shape Us (A Cuban Example), OnTheInternet, Vol. 4, No. 2, March/April, 1998, pp. 38-39, http://bpastudio.csudh.edu/fac/lpress/articles/cubanoti.doc. [↑](#endnote-ref-26)
27. Press, L., "Will Commercial Networks Prevail in Developing Nations?," OnTheInternet, March/April, 1997, pp 40-41, <http://som.csudh.edu/fac/lpress/articles/commerc.htm>. [↑](#endnote-ref-27)
28. Each test was 25 pings from a residential cable connection in Los Angeles. We did similar tests from a somewhat slower connection in Costa Rica, and observed considerably longer ping times and significantly more jitter. [↑](#endnote-ref-28)
29. See, for example, http://satellitetcp.com/chapters/SatTCP-chap13-satellitetcp.pdf. [↑](#endnote-ref-29)
30. World Bank database, queried January 2, 2011. [↑](#endnote-ref-30)
31. Huawei is among the top three mobile infrastructure equipment providers and is challenging Cisco and Juniper in the cabled market, see, for example, <http://en.wikipedia.org/wiki/Huawei> and <http://seekingalpha.com/article/198323-china-s-huawei-margins-market-share-and-cisco-s-router-business>. [↑](#endnote-ref-31)
32. U. S. Interests Section, Havana, Memo [10HAVANA84](file:///C:\Users\Larry%20Press\Desktop\cuba\wikileak_files\wikileak.htm), created 2010-02-09, released 2010-12-16, http://wikileaks.ch/cable/2010/02/10HAVANA84.html. [↑](#endnote-ref-32)
33. That has been the case in informatics and communications, as we will see below. [↑](#endnote-ref-33)
34. Around the same time, the Chinese evaluated the same policy and opted for control of the Internet combined with rapid adoption. One wonders what would have happened if Cuba had followed the Chinese example. [↑](#endnote-ref-34)
35. <http://www.mobileworldlive.com/maps/network_info.php?nid=6927&org_id=6924&cid=3216>. [↑](#endnote-ref-35)
36. International Telecommunication Union, updated 21 October 2010, <http://www.itu.int/ITU-D/ict/statistics/at_glance/KeyTelecom.html>. Figures for 2010 are estimates. [↑](#endnote-ref-36)
37. The value of the Cuban convertible peso (CUC) is currently pegged at US$1.08. [↑](#endnote-ref-37)
38. <http://data.worldbank.org/country/cuba>. [↑](#endnote-ref-38)
39. World Bank database, queried January 13, 2011. [↑](#endnote-ref-39)
40. <http://www.gsacom.com/news/gsa_315.php4>. [↑](#endnote-ref-40)
41. Telecom Italia, in GlobalComm Database, TeleGeography, <http://www.telegeography.com/product-info/global_comms/download/gcd-telecom-italia.pdf>. [↑](#endnote-ref-41)
42. <http://www.reuters.com/article/idUSTRE57R1A420090828>. [↑](#endnote-ref-42)
43. <http://www.peopleforum.cn/viewthread.php?tid=40393&highlight=cuba%2Bchina>. [↑](#endnote-ref-43)
44. <http://havanajournal.com/business/entry/cuba-trade-with-china-reaches-22billion-venezuela-7billion/>. [↑](#endnote-ref-44)
45. U. S. Interests Section, Havana, Memo [10HAVANA84](file:///C:\Users\Larry%20Press\Desktop\cuba\wikileak_files\wikileak.htm), created 2010-02-09, released 2010-12-16, http://wikileaks.ch/cable/2010/02/10HAVANA84.html. [↑](#endnote-ref-45)
46. Michel, Serge and Beuret, Michel, China Safari, Nation Books, New York, 2009. [↑](#endnote-ref-46)
47. Press, L. and Snyder, J., "A Look at Cuban Networks," Matrix News, 2(6), Matrix Information and Directory Services, Austin, June, 1992, <http://som.csudh.edu/fac/lpress/devnat/nations/cuba/cuba3.htm>. [↑](#endnote-ref-47)
48. Press, L. Cuban Telecommunications, Computer Networking, and U. S. Policy Implications, DRU-1330-1-OSD, Rand, Santa Monica, CA, July, 1996. [↑](#endnote-ref-48)
49. <http://www.conectatecuba.com/index.php?option=com_content&view=article&id=66:decreto-2091996-sobre-el-acceso-de-la-republica-de-cuba-a-redes-de-alcance-global&catid=125:resoluciones&Itemid=56>. [↑](#endnote-ref-49)
50. MIC Web site, <http://www.mic.gov.cu/>, queried December 2010. [↑](#endnote-ref-50)
51. It is conceivable that this is intentional in an effort to restrict all WiFi radios to channel 11 and above, but it is much more likely a careless error. [↑](#endnote-ref-51)
52. Azel, José, Is Cuba Moving Toward Capitalism?, Focus on Cuba, September 27, 2010, ctp.iccas.miami.edu/FOCUS\_Web/Issue132.htm. [↑](#endnote-ref-52)
53. http://en.wikipedia.org/wiki/Ramiro\_Vald%C3%A9s. [↑](#endnote-ref-53)
54. Hughes, John, What are 30,000 Cuban advisers doing in Venezuela?, Christian Science Monitor, March, 2010, www.csmonitor.com/Commentary/John-Hughes/2010/0316/The-Castro-Chavez-link-What-are-30-000-Cuban-advisers-doing-in-Venezuela. [↑](#endnote-ref-54)
55. **Statement by Ramiro Valdés Menéndez, Minister of Informatics and Communications at the opening of the 12th Editions of the Information Technology Convention and Fair 2007,** http://www.cubaminrex.cu/sociedad\_informacion/2007/DiscursoRamiro.htm. [↑](#endnote-ref-55)
56. Valdés is often characterized as highly conservative, but objective assessments are not available. For a typical, critical assessment of his career, see Amuchastegui, Domingo, Ramiro Valdés Menendez and his role in Raul'sregime, The Free Library, September, 2008, www.thefreelibrary.com/Ramiro+Valdes+Menendez+and+his+role+in+Raul's+regime.-a0184699618. [↑](#endnote-ref-56)
57. This statement is reminiscent of Jaron Lanier’s criticism of an Internet that is financed by advertising and serves commercial interests, Lanier, Jaron, You are not a Gadget, <http://www.amazon.com/gp/product/0307269647?ie=UTF8&tag=slatmaga-20&linkCode=as2&camp=1789&creative=390957&creativeASIN=0307269647> or FCC Chairman Newton Minnows call for television, which he characterized as a “vast wasteland,” to serve the public interest. [↑](#endnote-ref-57)
58. The change was announced January 7, 2010, <http://www.granma.cubaweb.cu/2011/01/07/pdf/pagina03.pdf>. [↑](#endnote-ref-58)
59. Press, Larry, A Computer Network for Democracy and Development, archive of communication during the Soviet coup attempt, State University of New York, August 26, 1991, http://www.cs.oswego.edu/~dab/coup/PAPERS/Press.txt. [↑](#endnote-ref-59)
60. Press, Larry, Relcom, an Approriate Technology Network, Proceedings of INET '92, International Networking Conference, Kobe, Japan, June, 1992, Internet Society, Reston, VA. Reprinted in The Proceedings of the Telecommunications Conference, Moscow, Russia, June, 1992, http://www.isoc.org/isoc/conferences/inet/92/proceedings/Applications\_A2\_RELCOM.pdf. [↑](#endnote-ref-60)
61. Press, Larry, Wide Area Collaboration, Communications of the ACM CACM Homepage archive Volume 34 Issue 12, Dec. 1991, http://0-delivery.acm.org.torofind.csudh.edu/10.1145/130000/125403/p21-press.pdf?key1=125403&key2=3405590921&coll=DL&dl=ACM&CFID=115361381&CFTOKEN=15286549. [↑](#endnote-ref-61)
62. Press, Larry, Cuban Telecommunications, Computer Networking and U. S. Policy Implications, DRU-1330-1-OSD, Santa Monica, CA: Rand, July 1996, http://www.rand.org/pubs/drafts/DRU1330-1/. [↑](#endnote-ref-62)
63. There are signs that Fidel Castro was open to both sides of the debate. He encouraged the establishment the Youth Computer Clubs and saw to it that they were well funded by Cuban standards. Oscar Visiedo, an early leader in Cuban networking, recalls that when he showed Fidel some rudimentary internet technology, he recognized the fact that if this was not something that Cuba developed (in whatever controlled fashion), Cuba would be left decades behind the rest of the world. In spite of this awareness, Castro allowed the hard liners and bureaucratic infighters to control the Internet. Need to confirm with Oscar xxx. [↑](#endnote-ref-63)
64. Clinton, Hillary Rodham, Remarks on Internet Freedom, The Newseum, Washington, DC, January 21, 2010, http://www.state.gov/secretary/rm/2010/01/135519.htm. [↑](#endnote-ref-64)
65. Chassay, Clancy, Resistance is our strategy (video), The Guardian, October 2007, http://www.guardian.co.uk/news/video/2007/oct/25/inside.gaza. [↑](#endnote-ref-65)
66. Shane, scott and Lehren, Andrew, Cables Shine Light Into Secret Diplomatic Channels, New York Times, November 28, 2010, http://www.nytimes.com/2010/11/29/world/29cables.html?\_r=2&pagewanted=print. [↑](#endnote-ref-66)
67. See, for example, Translating Cuba, <http://translatingcuba.com/>. [↑](#endnote-ref-67)
68. Huffington, Arianna, Facebook, Twitter and the Search for Peace in the Middle East, Huffington Post, November 24, 2010, http://www.huffingtonpost.com/arianna-huffington/facebook-twitter-and-the-\_b\_788378.html?utm\_source=DailyBrief&utm\_campaign=112610&utm\_medium=email&utm\_content=FeatureTitle&utm\_term=Daily+Brief. [↑](#endnote-ref-68)
69. Stone, Biz, Twitter and Activism, Atlantic Monthly, October 19 2010, http://www.theatlantic.com/technology/archive/2010/10/exclusive-biz-stone-on-twitter-and-activism/64772/. [↑](#endnote-ref-69)
70. Shirky, Clay, How Social Media Can Make History, Ted Talk, Ted@State, Washington DC, June 2009, http://www.ted.com/talks/clay\_shirky\_how\_cellphones\_twitter\_facebook\_can\_make\_history.html. [↑](#endnote-ref-70)
71. Gladwell, Malcolm, Small Change: Why the revolution will not be tweeted, New Yorker, October 4, 2010, http://www.newyorker.com/reporting/2010/10/04/101004fa\_fact\_gladwell?currentPage=all. [↑](#endnote-ref-71)
72. Esfandiari, Golanaz, The Twitter Devolution, June 7, 2010, http://www.foreignpolicy.com/articles/2010/06/07/the\_twitter\_revolution\_that\_wasnt?page=full. [↑](#endnote-ref-72)
73. Halper, Stefan, “The Beijing Consensus: How China’s Authoritarian Model Will Dominate the Twenty-first Century,” Basic Books, 2010. [↑](#endnote-ref-73)
74. Fallows, James, The Connection Has Been Reset, The Atlantic, March 2008, http://www.theatlantic.com/magazine/archive/2008/03/-ldquo-the-connection-has-been-reset-rdquo/6650/. [↑](#endnote-ref-74)
75. Guo, Liang, Surveying Internet Usage and its Impact in Seven Chinese Cities, Center for Social Development Chinese Academy of Social Sciences, November, 2007,

    <http://www.policyarchive.org/handle/10207/bitstreams/16013.pdf>. [↑](#endnote-ref-75)
76. <http://www.jovenclub.cu/index.php/es/quienes-somo>, <http://es.wikipedia.org/wiki/Joven_Club_de_Computaci%C3%B3n>. [↑](#endnote-ref-76)
77. ANUARIO ESTADÍSTICO DE CUBA 2009, Oficina Nacional de Estadisticas, 2010, <http://www.one.cu/aec2009/esp/17_tabla_cuadro.htm>. [↑](#endnote-ref-77)
78. There are also 289 public access computers in 54 post offices, but, unlike the YCCs, the post offices charge for access. [↑](#endnote-ref-78)
79. <http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/rt/printerFriendly/1164/1084> [↑](#endnote-ref-79)
80. Consider, for example, the relatively extensive class offerings at the Villa Clara YCC, <http://www.vcl.jovenclub.cu/index.php?option=com_content&view=article&id=451&Itemid=125>. [↑](#endnote-ref-80)
81. [Frydenberg](http://isedj.org/8/10/index.html) and Press (2010). From Computer Literacy to Web 2.0 Literacy: Teaching and Learning Information Technology Concepts Using Web 2.0 Tools. *Information Systems Education Journal, 8* (10). ISSN: 1545-679X, <http://isedj.org/8/10/index.html>. [↑](#endnote-ref-81)
82. <http://www.jovenclub.cu/> [↑](#endnote-ref-82)
83. [http://www.jovenclub.cu/index.php/es/component/bookmarks/?mode=0&catid=1&navstart=0&search=\*](http://www.jovenclub.cu/index.php/es/component/bookmarks/?mode=0&catid=1&navstart=0&search=*) [↑](#endnote-ref-83)
84. <http://sigdu.jovenclub.cu/index.php/es/postales> [↑](#endnote-ref-84)
85. However, only 4% of Cuban university graduates in 2008 had studied engineering (2%) or science (2%), World Bank education database, queried January 6, 2011. [↑](#endnote-ref-85)
86. ANUARIO ESTADÍSTICO DE CUBA 2009, Oficina Nacional de Estadisticas, 2010.

    http://www.one.cu/aec2009/esp/17\_tabla\_cuadro.htm. [↑](#endnote-ref-86)
87. <http://www.mes.edu.cu/index.php?option=com_remository&Itemid=28&func=startdown&id=11> [↑](#endnote-ref-87)
88. http://www.uci.cu/. [↑](#endnote-ref-88)
89. The Web site lists course names and I have somewhat arbitrarily combined them into the categories shown here. [↑](#endnote-ref-89)
90. <http://csc.csudh.edu/bscs>. [↑](#endnote-ref-90)
91. <http://coursecatalog.web.cmu.edu/schoolofcomputerscience/>. [↑](#endnote-ref-91)
92. Dirección de Turismo, Comercio y Servicios de Cuba, Tecnologias de la Información y las Communicaciones Uso y Acceso en Cuba, Septiembre 2010, <http://www.one.cu/publicaciones/06turismoycomercio/TIC/2009%20TIC%20Uso%20y%20Acceso%20en%20Cuba.pdf>. [↑](#endnote-ref-92)
93. ANUARIO ESTADÍSTICO DE CUBA 2009, Oficina Nacional de Estadisticas, 2010, <http://www.one.cu/aec2009/esp/17_tabla_cuadro.htm>. [↑](#endnote-ref-93)
94. World Bank database, queried January 1, 2011. [↑](#endnote-ref-94)
95. See the egov4development Web site for e-government techniques, applications and case studies, <http://www.egov4dev.org/index.shtml> [↑](#endnote-ref-95)
96. <http://www.infosoc.cu/>. [↑](#endnote-ref-96)
97. http://www.livinginternet.com/doc/merit.edu/acceptable\_use\_policy.htm. [↑](#endnote-ref-97)
98. <http://www.livinginternet.com/i/ii_nsfnet.htm>. [↑](#endnote-ref-98)
99. <http://news.netcraft.com/archives/2010/12/01/december-2010-web-server-survey.html>. The decline in The decline in early 2010 is due to a change in counting hosts at Chinese blogging site qq.com. [↑](#endnote-ref-99)
100. <http://listas.sld.cu/mailman/listinfo/bit-l>. [↑](#endnote-ref-100)
101. [Press, Larry](http://som.csudh.edu/fac/lpress/articles/CUBANOTI.DOC), We Shape our Tools and they Shape Us, The Cuban Example, OnTheInternet, Vol. 4, No. 2, March/April, 1998, pp. 36-39, http://som.csudh.edu/fac/lpress/articles/CUBANOTI.DOC. [↑](#endnote-ref-101)
102. This data was downloaded from the World Bank indicators database on January 1, 2011. Most of the data is from 2008 or 2009 with a few values from 2007. [↑](#endnote-ref-102)
103. Tecnologias de la informacion y las comunicaciones (TIC) use y acceso en Cuba, National Statistics Office, December 2007 <http://www.eclac.cl/socinfo/noticias/paginas/5/30205/cuba2007TIC.pdf>. [↑](#endnote-ref-103)
104. CENIAI director Jesus Martinez proudly announced the establishment of the IP link to his colleagues in the Latin American and Caribbean Networking Forum in an email found at: <http://www.nsrc.org/db/lookup/report.php?id=890202418874:497433358&fromISO=CU>.

     Martinez and his counterparts in the Forum met regularly and formed an enthusiastic, cross national “Internet culture.” The tone of Martinez’ announcement accurately reflects the early Internet culture throughout the world. [↑](#endnote-ref-104)
105. <http://www.mic.gov.cu/sitiomic//planillas/PROCEDIMIENTO%20SOLICITUD%20INSCRIPCION.doc>. [↑](#endnote-ref-105)
106. This data was taken from the World Bank online database, queried January 1 2011. The table includes upper-middle income Latin American and Caribbean nations that reported values for the series between 2002 and 2008. The latest available data were used. Enrollment rates are a percent of the 18-22 year old population. [↑](#endnote-ref-106)
107. Of course there is a risk that people are being educated for non-existent jobs. This is particularly likely in a nation with a command economy. [↑](#endnote-ref-107)