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## CHAPTER 4

### CUBA

#### Executive Summary

Cuba is the largest, most populous Caribbean nation. It is a Communist nation, and the economy is hampered by the inefficiency of a planned economy and the U.S. embargo. The fall of Soviet Communism dealt Cuba a severe economic blow, cutting deeply into trade and GDP, and eliminating Soviet subsidies. The economy is depressed, but beginning to rebound, and several reforms have been undertaken. In spite of the poor economy, the Cuban revolution accomplished major achievements in health care, education, and equality, and the government enjoys popular support.

Cuba's international Internet connectivity began with an unreliable UUCP link to Canada in 1991, and grew to four active UUCP links by 1994. In late 1996, the four UUCP links were replaced by a single, 64 Kbps IP link to the United States.

Intranationally, four networks provide connectivity for others: the Center for Automated Exchange of Information (CENIAI), Teledatos, the National Network for Science and Technology (RENACYT), and Infomed. CENIAI operates the IP link, and connects many networks together and to the Internet. Teledatos is the second most active organization. It initially served the tourism industry, but is now expanding to serve other government and business organizations. Infomed connects some other networks, but concentrates on the health community. RENACYT, which provides many internal connection, is hampered by use of X.25 technology.

Cuba's international connectivity is nearly the lowest in Latin America and the Caribbean. This is in contrast to relatively high levels of intranational local and wide-area (predominantly UUCP) networking. Cuban organizations also operate Web servers with news, cultural, and commercial (primarily tourism) information in North America. The paucity of IP Internet connectivity leaves Cuba at low levels in every dimension (Table 27). Figure 11 depicts the development of the Internet dimensions in Cuba.

After a spurt of networking activity in the early 1990s, the Cuban leadership became concerned that the network might threaten its cultural values and the stability of the regime, but at the same time realized that the Internet was a potential economic and educational tool. Faced with this dilemma, they slowed growth and spent time assessing risks and opportunities and deciding what to do and who would do it.

An Inter-ministerial Committee on Networking was formed to oversee and control Cuban networking and to produce a strategic plan for information. Connectivity of non-governmental organizations, some of which were viewed as subversive, was cut back, and the four international links were consolidated into one. Access and content were restricted to professionals and professional concerns. These measures are economical, but also facilitate control over the network.

While the Internet does not seem to be particularly important for either the United States or Cuba as a propaganda vehicle, it may be more important during a crisis (such as the Soviet coup attempt), for a relatively new situation in which the principals have access (as in Chiapas), or in improving the efficiency of organizations opposed to the regime—in both legal and illegal (conspiratorial) activities.

Dimension	Level	Explanation
Pervasiveness	(1) <i>Experimental</i>	IP connectivity is minimal, with perhaps as few as 100 users. Even including UUCP e-mail accounts, fewer than one in 1,000 Cubans has Internet access. It is noteworthy that e-mail use extends well beyond the network technician community.
Geographic Dispersion	(1) <i>Single Location</i>	The only IP point of presence offering network connectivity is in Havana. However, there is e-mail access in every province and nearly every municipality. There is an interest in dispersion.
Sectoral Absorption	(1) <i>Rare</i>	IP connectivity is rare in the health and government sectors, and nonexistent in education and commerce. However, there is e-mail use in the health sector throughout the nation, more than 10 percent of the ministries have e-mail accounts, and Youth Computer Clubs (academic sector) are nationwide.
Connectivity Infrastructure	(1)	There is a single international IP link, no domestic backbone, and barely any leased line access. Cuba is severely hampered by poor telephone infrastructure and historical concentration on X.25.
Organizational Infrastructure	(2) <i>Controlled</i>	Two entities provide connectivity to organizations with networks, and there is some degree of competition. Some coordination is provided by the Inter-ministerial Committee for Networking.
Sophistication of Use	(1) <i>Minimal</i>	There is little IP connectivity; however, e-mail and information retrieval from e-mail-driven servers have reached the conventional level in the health care and biotechnology communities.

Table 27. Internet Dimensions for Cuba

Even if Cuba were not politically ambivalent, network growth would be severely constrained by what is one of the worst telecommunication infrastructures in Latin America and the Caribbean. The telephone company (ETECSA) was partially privatized in 1994, but the original investor, Grupo Domos of Mexico, has defaulted and is no longer participating. The Italian telecommunications holding company *Società Finanziaria Telefonica p.a.* (STET) owns approximately 29 percent of ETECSA, and is making investments in both telephony and data networking. Still, the infrastructure is very poor, and the Communist government and U.S. embargo make it difficult to attract capital.

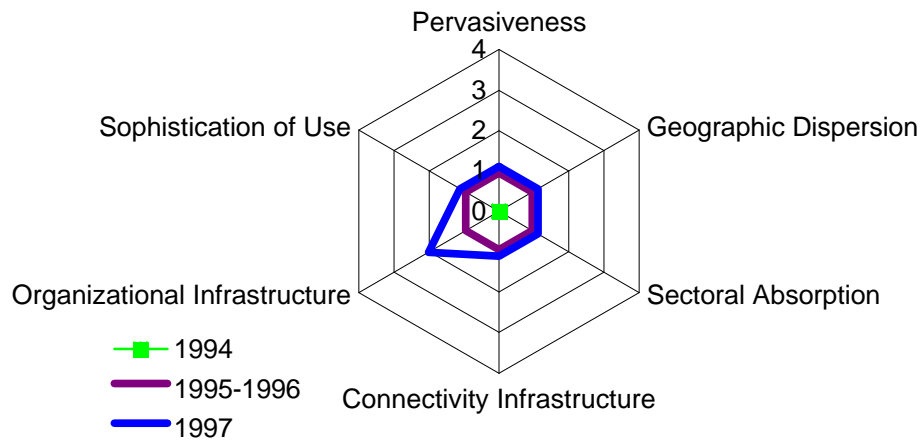


Figure 11. Internet Dimensions for Cuba

Economic problems and difficulty attracting capital are mitigated somewhat by Cuba's well-educated labor pool; however, many lack training with current technology. Cuba's traditional emphasis on education, coupled with a strategy that emphasizes the development of internal networks, has resulted in a community of enthusiastic and resourceful technicians, but they are hampered in their lack of access to modern equipment and technical information.

Cuban networking has not moved as quickly toward commercial domination as in other nations—there is atypical emphasis on health care, government, and education. Its networks and telephone infrastructure are also unusual for developing nations in the degree of emphasis placed on development outside of the capital city, and this may prove a long-run advantage.

In every nation, networks reflect the values of the society, political and economic systems, economic prosperity, and other social factors. Cuba is unique in many ways, and its networks reflect that. We see geographic dispersion, a concentration on internal networking, and relatively little commercial activity.

## Introduction

We shape our tools and they shape us. The Internet has the potential to change commerce, education, recreation, the process of government, etc. in a nation, but it is also shaped by the values, laws, politics, economy, etc., of that nation.

Infrastructure shapes society and society shapes infrastructure.

The Internet is concentrated in developed, democratic, capitalist nations. Cuba (Figure 12) is neither developed, democratic, nor capitalist, and in our inductive study, we hope to learn from such variety. Cuba's Internet reflects the society. For example, Cuba was late to come to the Internet. Its international connectivity is meager relative to internal networking activity. Cuban networking is relatively non-commercial, and is geographically diffuse.



Figure 12. Map of Cuba

Cuba is the largest, most populous Caribbean nation (Table 28), and has been governed as a Communist dictatorship for nearly 40 years. There is tight control over information and dissent, and Cuban mass media and education stress the hostility of the United States and its economic embargo, and the considerable achievements of the revolution in education, health care, and equality.

In spite of very difficult economic conditions, the revolution enjoys considerable support. A

Table 28. Cuba in Statistics		
Metric	Value <sup>43</sup>	Remarks
Population	11.01	millions, 1995
Population density	96	per km <sup>2</sup> , 1995
GDP	18.4	US\$billions, 1994
GDP per capita	1,679	US\$, 1994
Telephones	353.2	thousands, 1995
Teledensity	3.21	per 100 inhabitants, 1995
Teledensity in largest city	7.36	per 100 inhabitants, 1995
Cellular subscribers	1.9	thousands, 1995
Cellular density	0.02	per 100 inhabitants, 1995
PCs	na	
PC density	na	
Television sets (receivers)	2,200	thousands, 1995
Television density	20.0	per 100 inhabitants, 1995
Literacy rate	95.7 <sup>44</sup>	per 100 inhabitants older than 15 years, 1995
Infant mortality	9.0 <sup>45</sup>	per 1000 inhabitants, 1996 estimate

*Miami Herald* survey<sup>46</sup> taken in November 1994 (at an economic low point) found 54 percent of the people pro-regime, 25 percent unengaged, and 23 percent alienated. Sixty-two percent felt the performance of the national government was good (23 percent poor), and 69 percent felt the government protects human rights (23 percent abuses). Fifty-eight percent felt the revolution had more achievements than failures (31

percent more failures).

<sup>43</sup> Source: *World Telecommunication Development Report*, 3rd ed., 1996/97 (Geneva: International Telecommunications Union, March 1997), unless otherwise noted.

<sup>44</sup> *The World Factbook 1996*, <<http://www.odci.gov/cia/publications/nsolo/factbook/cu.htm>> (22 January 1998).

<sup>45</sup> *ibid.*

<sup>46</sup> Mimi Whitefield and Mary Beth Sheridan, "Cuba Poll: The Findings," *The Miami Herald* (18 December 1994), p. 1.

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After years of stable, subsidized trade and intellectual exchanges with Communist nations, the Cuban economy was hit very hard by the fall of Soviet Communism. Total trade (exports plus imports) fell from US\$13,500 million in 1989 to a low of US\$3,164.9 in 1993, but by 1996 had rebounded to US\$5,329.5.<sup>47</sup> GDP fell by roughly 35 percent during this period, but has also bottomed out.<sup>48</sup> Cuba also lost billions of dollars in annual Soviet oil and sugar price subsidies. The U.S. embargo and Cuba's state-controlled socialist economy have further discouraged business and capital formation. To offset these difficulties, Cuba has actively sought external investment in recent years with some market reforms, free trade zones, and openness to foreign ownership.

These economic difficulties have left Cuba with what is arguably the worst telecommunications infrastructure in Latin America and the Caribbean. E-mail connectivity to the Internet began in 1991, and grew relatively rapidly until 1994-95, at which time there was a pause while it was decided how Cuba would participate in the Internet and who would be responsible for implementation. At this time, Cuba has little international connectivity relative to its intranational networks and technical capabilities.

### Networks in Cuba

Many Cuban organizations and enterprises have "networks." These may be a single time-shared PC on which several people have e-mail accounts to which they connect via telephone or X.25, or LANs with IP or UUCP links to other networks. As in most developing nations, there is nothing comparable to the IP backbones found in more developed nations.

Cuban connectivity to the Internet began in 1991 with a UUCP link between the Center for Automated Exchange of Information (CENIAI) and Web/NIRV, an Association for Progressive Communications (APC) affiliate in Toronto. Traffic was exchanged about once per day, and there were frequent interruptions for technical or financial reasons. The state of Cuban networking in early 1992 was summarized previously by Press and Snyder.<sup>49</sup>

By early 1995,<sup>50</sup> there were four networks with international UUCP links: CENIAI; the Center for Genetic Engineering and Biotechnology (CIGB); TinoRed, a network serving primarily non-governmental organizations (NGO) and Cuban Youth Computer Clubs (YCC); Infomed, serving the medical community; and an X.25-based tourism network. International e-mail traffic was over 60,000 bytes per month, approximately 28 percent inbound to Cuba, and there were over 2,600 users (Table 29). Internally, Cuba had many LANs, UUCP links (over telephone and X.25 connections), IP intranets, and notable skill and enthusiasm in the technical community, but there was still no international IP link.

In 1997, the four international UUCP networks were replaced with an IP link from CENIAI to Sprint in the United States. CENIAI has IP links to nine other networks in Havana as well as to its own Internet Services Division. Infomed has nodes in each of Cuba's provinces. CIGB has UUCP links between its centers in two provinces and Havana. TinoRed's YCCs have proliferated,

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<sup>47</sup> National Bank of Cuba, *Economic Eye on Cuba* (27 October 1997), <<http://www.cubatrade.org/eyeonk.html>>.

<sup>48</sup> *ibid.*

<sup>49</sup> L. Press and J. Snyder, "A Look at Cuban Networks," *Matrix News 2* (Austin, TX: Matrix Information and Directory Services, June 1992).

<sup>50</sup> Larry Press and Carlos Armas "Cuban Network Update," *OnTheInternet* (January/February 1996), pp. 46-49.

but Red David, which served NGOs, is gone. The tourism network now serves government and business customers as well as the tourist industry.

Table 29. <sup>51</sup> Monthly International E-mail Traffic With Cuba, 1995		
Network	Kilobytes of Traffic	Accounts (minimum)
TinoRed	16,709	413
CENIAI	16,481	732
Infomed	14,000	500
CIGBnet	13,441	950
Total	60,631	2,595

Cuba's intranational networking gains have been strong in comparison to progress in international connectivity. As of July 1997, the .cu national TLC had only 67 hosts in 14 domains,<sup>52</sup> and in December 1997, the University of Costa Rica<sup>53</sup> listed only 129 hosts in 21 domains for Cuba (Table 30). The only Latin American or Caribbean nations with fewer Internet hosts per capita than Cuba were the Falkland Islands and Haiti. Table 31 compares Cuban IP hosts relative to other Caribbean nations with over 1 million population.

Table 30. <sup>54</sup> Cuban Computers, Internet IP Hosts and Users, and E-mail		
	Number	Number per 1,000 inhabitants
Computers	62,757	5.70
IP hosts	129	0.01
E-mail accounts <sup>55</sup>	3,000	0.27
E-mail institutions	70	0.01
Internet IP Users	100	0.01

<sup>51</sup> Sources: Infomed traffic, e-mail message from Juan Reardon (9 March 1995), <<http://www.igc.apc.org/cubasoli>>; others' traffic, personal e-mail message from Riff Fullan, <[intlinfo@web.apc.org](mailto:intlinfo@web.apc.org); users>; L. Press, *Cuban Telecommunications, Computer Networking and US Policy Implications*, DRU-1330-1-OSD (Santa Monica, CA: Rand, July 1996).

<sup>52</sup> Network Wizards, <<http://www.nw.com/>>.

<sup>53</sup> University of Costa Rica, <<http://ns.cr/latstat/>>.

<sup>54</sup> Sources: Computers: *Economic Eye on Cuba* (1 September 1997); Hosts: University of Costa Rica, *ibid.*; E-mail users: CENIAI; E-mail institutions and Internet IP users: "Internet, The Printing Press of our Times," *Granma International*, 3 December 1997, <<http://www.granma.cu/dic97-3/49dic10i.html>>.

<sup>55</sup> Accounts that had been active at least once per month for the prior three months.

Nation	Population (millions)	Hosts	Hosts per 1000 inhabitants
Trinidad and Tobago	1.3	552	0.434
Dominican Republic	7.8	3,155	0.397
Jamaica	2.5	367	0.143
Puerto Rico	3.6	160	0.042
Cuba	11.0	129	0.012
Haiti	7.2	0	0.0

### Connecting Networks

Four Cuban networks provide connectivity for other organizations (Figure 13), somewhat analogous to ISPs in other nations. CENIAI and the National Network for Science and Technology (RENACYT) have been in the data communications field since it began in Cuba. Teledatos and Infomed are newer, having been formed to support the critical tourism and health care industries.

Ministry of Science, Technology and the Environment (CITMA) Agency for Information for Development (AID) Institute for Scientific and Technological Information (IDICT) Center for Automated Exchange of Information ( <b>CENIAI</b> ) Institute of Cybernetics, Mathematics and Physics (ICIMAF) Center for Teleinformatic Research and Development (CIDET) National Network for Science and Technology ( <b>RENACYT</b> )  Ministry of Steel, Mechanical and Electrical Industries (SIME) Group for Electronics in Tourism (GET) <b>Teledatos</b>  Ministry of Public Health (MINSAP) National Center For Medical Sciences Information <b>Infomed</b>
Figure 13. Location of Cuban connecting networks within their ministries

### The CENIAI Network

CENIAI ([www.ceniai.inf.cu](http://www.ceniai.inf.cu)) is Cuba's oldest networking organization. It is housed in a prestigious location at the capital building, and is one of five divisions of the Institute for Scientific and Technological Information (IDICT), which is one of nine organizations making up of the Agency for Information for



<sup>56</sup> University of Costa Rica, *op. cit.*

Development (AID) in the Ministry of Science, Technology, and the Environment (CITMA). RENACYT is also part of AID. IDICT is over 30 years old, and CENIAI has worked on data communications since 1982. Along with researchers from all Communist nations, CENIAI accessed large bibliographic databases (reminiscent of DIALOG) at Moscow's Institute for Scientific and Technical Documentation over the Soviet X.25 research network. In 1991, CENIAI established the UUCP link mentioned above, and for the first time Cubans could communicate directly with Western colleagues. Initially, all international traffic was routed through CENIAI, which provided gateway service for several small intranational networks.

In October 1996, with technical assistance from the Organization for American States and the Latin American and Caribbean Networking Forum, CENIAI established a 64 Kbps IP link to Sprint in the United States, at a cost of \$10,000 per month.<sup>57</sup> In February 1997, CENIAI took over administration of the .cu domain from Web/NIRV. Within Cuba, they provide IP connectivity at 64 Kbps to nine networks in Havana, and their own Internet services operation is on the same 10 Mbps LAN (30 machines) as the IP router (Table 32). They also poll many UUCP networks.

Table 32. <sup>58</sup> Networks with IP Connectivity to CENIAI
BNC
CENIAI Internet
DataCIMEX
Infomed
Ministry of the Interior
Ministry of Culture
Ministry of Communication
MIP
RENACYT
SIME
TinoRed
UN Development Program (UNDP)

While Cuba has international IP connectivity, it is very limited. A recent *Granma* article estimated that only 100 Cubans had direct access to the Internet.<sup>59</sup> The majority of Cuban users access the Internet via UUCP e-mail, which is routed through CENIAI.

CENIAI's Internet services arm does Web and bulletin board services (BBS) development, and operates Web, list, news, and gopher servers. Traffic has grown rapidly since the IP link was established, and the international link is now saturated. CENIAI hopes to upgrade the Sprint link to 256 Kbps soon, and may obtain a link to Italy as well. International circuits are provided by the Cuban telephone company, Empresa de Telecomunicaciones de Cuba, S.A. (ETECSA). To

<sup>57</sup> The \$10,000 figure was provided by a Cuban official. Comments in this chapter attributed to "officials" are based on interviews or e-mail messages with correspondents who requested anonymity.

<sup>58</sup> Source: Jesus Martinez, Unpublished Presentation at *Info '97*, Havana, (October 1997).

<sup>59</sup> "Internet, The Printing Press..." *op. cit.*



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lighten the bandwidth load, the CENIAI web server is mirrored at the Scientific Network of Peru ([www2.ceniai.inf.cu](http://www2.ceniai.inf.cu)) but it is not mirrored in North America or Europe, so access is still slow from those regions.



### *The RENACYT*

RENACYT is a service of the Center for Teleinformatic Research and Development (CIDET) of the Institute of Cybernetics, Mathematics, and Physics (ICIMAF). Like IDICT/CENIAI, ICIMAF is part of AID. CIDET has been involved throughout the history of Cuban networking, having designed and manufactured X.25 packet assembler/disassemblers (PAD) and switches.

RENACYT's primary role is in connecting various networks, including CENIAI and Infomed. They are internal to Cuba, and carry 62 percent of all e-mail traffic. While important, RENACYT is limited to UUCP traffic over X.25 links. The equipment they use lacks sufficient memory and speed to encapsulate IP over X.25,<sup>60</sup> and X.25 is inefficient for the routing of IP traffic even when it is feasible.

### *Teledatos*

Teledatos ([206.130.183.203/teledatos/whatis.html](http://206.130.183.203/teledatos/whatis.html)) is a division of GET, the Group for Electronics in Tourism. GET is part of the Ministry of Steel, Mechanical, and Electrical Industries (SIME), and is responsible for integrating telecommunications and computer equipment in the tourist industry.<sup>61</sup> SIME also contains the Central Institute for Digital Research (ICID), which developed the first Cuban computer (a DEC PDP-8 equivalent) in 1970.<sup>62</sup> GET may have been an ICID spin-off charged with supporting the tourism industry, a strategic source of investment and hard currency. GET installs and maintains computers and facsimile machines and develops tourism applications.

Teledatos is the GET division responsible for networking. It operates an X.25 network with nodes in Havana, Varadero (a tourist center), Caya Largo, Cienfuegos, Holguin, and Santiago de Cuba. It also claims a link to Madrid, probably in support of Spanish hotel chains operating in Cuba. Foster<sup>63</sup> reported that Teledatos had invested US\$1 million in this network in 1996, and planned to invest US\$1-2 million more. The new equipment they are installing is capable of supporting IP over X.25, and of being upgraded to Frame Relay.

Teledatos has gone well beyond tourism, providing connectivity to 12 ministries, provincial governments, and other networks (Table 33). Teledatos (and other organizations) offer many of the same value-added services as CENIAI, although Teledatos operates what appears to be a unique facsimile/e-mail gateway service. It is noteworthy that CENIAI provides connectivity to some of the same ministries as Teledatos. This indicates a degree of competition between the two, and CENIAI and AID officials stated that in fact they were open to and expecting competition.

GET and a Canadian partner have formed Internet Cubaweb Communication Corporation, a joint venture that operates a very successful web server in Canada ([www.cubaweb.cu](http://www.cubaweb.cu)). This web site

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<sup>60</sup> Will Foster, *Informatics and Telematics in Cuba* (Tucson, AZ: University of Arizona, 17 June 1996).

<sup>61</sup> *ibid.*

<sup>62</sup> MOSAIC Group, *Cuban Informatics 1992 Status Report* (Tucson, AZ: University of Arizona, 8 October 1992).

<sup>63</sup> Foster, *op. cit.*

claims it is in the top 5 percent worldwide in terms of visits. Cubaweb hosts a wide variety of information about Cuba and tourism. It has home pages for the Ministry of Tourism and many travel companies and hotel chains,<sup>64</sup> and offers popular money-transfer service for foreigners wishing to send money to friends and relatives in Cuba. Cubaweb also hosts publications, including *Granma International Online*, *Revolutionary Youth Online*, and *Workers Online*, which are edited in Cuba. Since this server is located at a relatively high-bandwidth site in North America, access is much faster than with the CENIAI servers.

Table 33. <sup>65</sup> Networks Connected by the GET Teledatos Network	
<b>Tourism</b>	<b>Ministries</b>
Solmelia	Ministry of Tourism
Trust Gran Caribe	Ministry of Hydraulic Resources
Trust Horizons	Ministry of Communication
Trust Islazul	Ministry of Internal Affairs
Caracol	Ministry of Basic Industry
Cubanacan	Ministry of Transport
Rumbos	Ministry of Agriculture
Transtur	Ministry of Internal Trade
Abatur	Ministry of Foreign Trade
	Ministry of Light Industry
	Ministry of Sugar
	Ministry of Culture
<b>Other Organizations</b>	<b>Other Government</b>
Institute of Meteorology	National Assembly
Institute of Radio and TV	State Department
National Bank of Cuba	Provincial Governments

The relationship between Teledatos and ETECSA is not clear. ETECSA is implementing an X.25-based national data network, and is said to be working with GET. The Teledatos network may be physically distinct from the ETECSA network or Teledatos may be a customer of ETECSA.

*Infomed*



Infomed ([www.infomed.sld.cu/](http://www.infomed.sld.cu/)), established in 1992, is a project of the National Center For Medical Sciences Information of the Ministry of Public Health (MINSAP), and its goal is “to facilitate the exchange of electronic information in the fields of medicine, biomedicine, and general health, and to facilitate the linkages between professionals, academicians, researchers, functionaries, and public health workers in Cuba and abroad.”<sup>66</sup>

<sup>64</sup> One chain, Cubanacan, claims 120,000 hits per week at their home page (<<http://www.cubanacan.cu/>>). Their success on the Web has led them to open an Internet-oriented public relations firm in Havana.

<sup>65</sup> Source: <http://www.cubaweb.cu/teledatos/usuarios.html>.

<sup>66</sup> Pedro Urrea, “La red electrónica de información de salud: INFOMED,” *Proceedings of the International*

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While focused on health information, Infomed also provides connectivity for other organizations. Before international traffic was consolidated under CENIAI, Infomed had its own UUCP link to GreenNet, an APC affiliate, in the United Kingdom.

Infomed was originally funded by the World and Pan American Health Organizations and subsequently received US\$250,000 from the UNDP for construction of nodes in medical schools in each provincial capital.

The network consists of a primary node in Havana (with a 64 Kbps IP link to CENIAI) which connects to regional nodes in Villa Clara, Camaguey, and Santiago de Cuba. These in turn link to secondary nodes in the remaining provincial capitals (Figure 14). There are 14.4 Kbps IP links from the regional nodes to Havana and IP or UUCP links from regional nodes to the secondary nodes.<sup>67</sup> In addition to the hardware, Infomed has people in each province, and provides training.

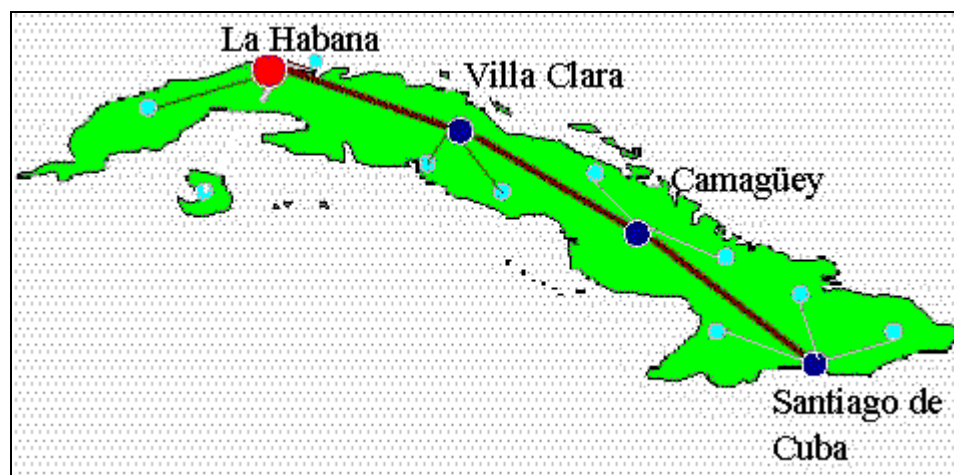


Figure 14.<sup>68</sup> The Infomed Network

The primary node in Havana has two Pentium Pro servers with 128 MB memory and 7 GB RAID disks running Linux. This is impressive in a nation where most machines are still i80286-based PCs. These servers are on a Novell LAN with a variety of machines from '286s on up. According to Infomed staff, the central node has around 600 users, and Infomed services between 2,500-3,000 people overall.<sup>69</sup>

There are LANs with Linux-based servers in each regional or secondary node, so staff are learning to work with IP intranets. The nodes are located in provincial medical schools, but a large pediatric hospital will soon be linked as will teaching laboratories in each of the medical schools. They eventually hope to reach each of Cuba's 70,000 doctors and 200,000 health care workers, but this will require public access centers.

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*Workshop on Telematics and the University in the Development of Local Health Systems*, Havana, 2-6 June 1997, <<http://infonew.sld.cu/taller/t-11.htm>>, pp. 60-64

<sup>67</sup> Seven Infomed links were IP in October 1997.

<sup>68</sup> Urra, *op. cit.*

<sup>69</sup> This seems inconsistent with the CENIAI estimate of 3,000 accounts nationwide; however, the definition of "user" is fluid, particularly in Cuba, where an entire institute may share a single UUCP e-mail account. In some sense, all of the youth with access to TinoRed are potential "users."

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While Infomed does connect other networks, they focus their effort on medical applications, including data retrieval and listservers. Those with IP connectivity can also access Infomed's Web server and ISIS databases using a graphical browser. Infomed collaborated in the design of the Cubaweb server, but their own Web server is in Cuba.

### *Inter-City Networks*

A number of organizations operate significant inter-city networks that connect to CENIAI or RENACYT. We will describe four of the more important ones, TinoRed, CIGB, and networks run by banks and tourism schools.

#### *TinoRed*

TinoRed was established by the Union of Young Communists with explicit support from Fidel Castro. Previously, TinoRed served two primary constituencies, Red David, an NGO network, and the YCCs, walk-in computer centers distributed throughout the nation. They established an international UUCP link to Web/NIRV in Toronto.

In 1992, TinoRed headquarters had a single i80386-based PC running UNIX as their central node in Havana. Today there are several Pentium PCs, and two training laboratories with machines. They route e-mail traffic over an IP link to CENIAI. The Red David NGOs no longer have accounts, but the YCCs are doing well.

There are now YCCs in all but five of Cuba's 169 municipalities, and all have computers, running Windows 95, and modems.<sup>70</sup> The clubs have 1,100 computers. The YCCs offer access to computers and games, productivity software, and classes. They estimate that 135,000 people have taken classes at YCCs in the ten years they have operated. TinoRed had a difficult time surviving financially during the mid 1990s, but today it is stable and planning to continue expansion. It has proposed establishing LANs with eight PCs in each of the provincial capitals, connected to Havana, and running IP over X.25 or leased lines.

#### *CIGBnet*

The Center for Genetic Engineering and Biotechnology (CIGB) was founded in 1986 and occupies 43,200 square meters of offices and laboratories on a Havana campus.<sup>71</sup> They have two other centers in Havana, one in Camaguey and another in Sancti Spiritus. Their network supports both research and Heber Biotec, the company that markets CIGB products in over 80 nations.

Fiber optic cable connects the four main buildings on the CIGB campus and there are 10 Mbps 10baseT drops to over 200 computers. There are 10 Mbps Ethernet LANs with 7-15 computers at each of the other locations. The central campus, Camaguey, and one of the Havana centers route UUCP traffic via leased lines to RENACYT using X.25, the other two over dial-up links.

Before CENIAI consolidated international traffic, CIGB operated a UUCP link to Web/NIRV in Toronto. CIGB runs IP on its LANs, and has thus gained experience with IP as well as UUCP networking. CIGB operates FTP, mail, list, and Web servers, and has developed applications for both Web browser and e-mail-based database access. The operators of CIGBnet have gained

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<sup>70</sup> Interview with TinoRed staff (October 1997).

<sup>71</sup> Nelson Lopez, Viena Garcia, Carlos Armas, Felix Miguel Aroma, Ricardo Ricardo, and Luis Lorenzo-Luaces, "CIGB Intranet," *Proceedings of INET '97*, Kuala Lumpur (Reston, VA: Internet Society, 1997).

considerable experience with IP networking and innovative solutions to problems since beginning UUCP e-mail in 1991. CIGB's Internet Web server is hosted in Canada.

### *Bank Networks*

Cuba has two bank chains, the Cuban National Bank, which serves business and completes international transactions, and the Popular Savings Bank, which serves the general population. As shown in Table 34, the banks' major information technology investments in recent years have been in computers and LANs, not wide area networking (although there is some X.25 communication). In addition to installing computers in banking offices, they have developed secure messaging and office (not customer) transaction-processing software packages.

	Cuban National Bank		Popular Savings Bank	
	12/94	10/96	12/94	10/96
Offices	210	211	250	247
Automated Offices	0	206	5	247
Computers	242	3,289	70	2,519

Like the nation, the banks seem to be following the strategy of building internal strength ahead of external connectivity, and the National Bank plans to network its offices over the next three years. This networking will probably be tied to older technology, since the Cuban banking application packages are written for DOS-based computers with as little as 4 MB memory and NetWare LANs, and they are designed for X.25 communication. This is understandable given the installed base of machines in Cuba, but it may be short-sighted. The cost of a powerful, Windows-based, IP-ready computer is now under \$1,000, and as manufacturers are working to broaden the commercial market, the price will surely fall. Targeting platforms like DOS and X.25 leads to software that is limited in its features and difficult to use, and perhaps more important for the long run, it limits the experience of the developers.

### *Tourist School Network*

Tourism is a critical Cuban industry, and as such, the government has established a chain of twenty schools of hotel operation and tourism throughout the island. The network serving this chain is more typical than Infomed, which received external funding. Of the twenty schools, fifteen have e-mail today, and traffic is exchanged using UUCP over X.25 or dial-up links. It is also interesting to note that they participate in at least one limited metropolitan-area network in the province of Camaguey, exchanging mail between Camaguey University, Infomed at the Medical High School, a sugar industry service center, a software company, and the tourism school.

### *Internet Dimensions*

Table 35 summarizes the Internet dimensions for Cuba, which are depicted in Figure 15.

<sup>72</sup> Source: Cuban banking system brochure.

Dimension	Level	Explanation
Pervasiveness	(1) <i>Experimental</i>	IP connectivity is minimal, with perhaps as few as 100 users. Even including UUCP e-mail accounts, fewer than one in 1,000 Cubans has Internet access. It is noteworthy that e-mail use extends well beyond the network technician community.
Geographic Dispersion	(1) <i>Single Location</i>	The only IP point of presence offering network connectivity is in Havana. However, there is e-mail access in every province and nearly every municipality. There is an interest in dispersion.
Sectoral Absorption	(1) <i>Rare</i>	IP connectivity is rare in the health and government sectors, and nonexistent in education and commerce. However, there is e-mail use in the health sector throughout the nation, more than 10 percent of the ministries have e-mail accounts, and Youth Computer Clubs (academic sector) are nationwide.
Connectivity Infrastructure	(1)	There is a single international IP link, no domestic backbone, and barely any leased line access. Cuba is severely hampered by poor telephone infrastructure and historical concentration on X.25.
Organizational Infrastructure	(2) <i>Controlled</i>	Two entities provide connectivity to organizations with networks, and there is some degree of competition. Some coordination is provided by the Interministerial Committee for Networking.
Sophistication of Use	(1) <i>Minimal</i>	There is little IP connectivity; however, e-mail and information retrieval from e-mail-driven servers have reached the conventional level in the health care and biotechnology communities.

Table 35. Internet Dimensions for Cuba

## Determinants

This section discusses some of the major factors that have shaped and constrained the Cuban networks. These determining factors, and the dimensions on which they have primary impact, are shown in Table 36.

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### Telephone Infrastructure

The poor quality of the Cuban telephone infrastructure has constrained growth in each of the dimensions, particularly in pervasiveness and geographic dispersion. There is little equipment today, and there has been little growth or improvement since the revolution. In 1957, about two

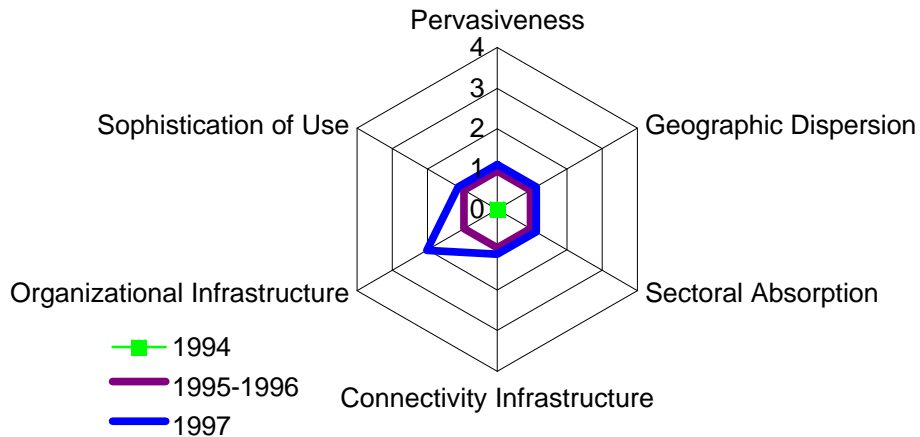


Figure 15. Internet Dimensions for Cuba

years before the revolution, Cuban long distance telephone rates were doubled, and the metering of local calls began. After the revolution, those price increases were rolled back. At the time, Cuba had 170,000 main lines (2.44 per 100 people). By 1995 there were only 353,200 main lines (3.21 per 100 people). The per-capita increase was only 32 percent during this period. (Table 37)

Determining Factor	Dimensions most directly affected
Poor telephone infrastructure	Pervasiveness, Geographic Dispersion, Connectivity Infrastructure, Sophistication of Use—All are inhibited due to the difficulty in connecting end users and networks.
Difficulty Attracting Capital	Connectivity Infrastructure—cannot be improved without capital
Cultural values stressing health, education and equality	Sectoral Absorption—emphasized in the health and educational sectors Geographic Dispersion—emphasized outside the capital
Centralized planning	Pervasiveness—reduced by the planning process delays
Concern for national security given US hostility	Pervasiveness—reduced by content and access restrictions
Protection of embargoed business activity	Pervasiveness—reduced by content and access restrictions
Propaganda to and from US	Pervasiveness—reduced by content and access restrictions
Threat of use by subversive organizations	Pervasiveness—reduced by content and access restrictions
Non-commercial economy	Sectoral Absorption—inhibited in the commercial sector as resources are shifted elsewhere
Populist history	Geographic Dispersion—increased by desire to serve rural areas and small towns Connectivity Infrastructure—extended outside the capital
Emphasis on human capital	Sectoral Absorption—increased in the academic sector

	1959	1992	1994	1995
Cuban Population	6,977,229	10,785,800	10,989,400	11,010,000
Havana Population	860,798 <sup>74</sup>	2,142,100	2,175,200	2,179,980
Percent in Havana	12%	20%	20%	20%
Main telephone lines	170,000	336,945	349,471	353,200
Main lines in Havana	124,100	153,287	156,937	160,500
Percent in Havana	73%	45%	45%	45%
Lines/100 capita, Cuba	2.44	3.12	3.18	3.21
Lines/100 capita, Havana	14.42	7.16	7.21	7.36
Public Telephones	na	10,003	5,814	6,030

Note that, while low, the growth rate outside Havana was substantially higher than in Havana. The percent of main lines in Havana fell from 73 percent in 1959 to 45 percent in 1995, and

<sup>73</sup> Sources: 1992 and 1994, International Telecommunication Union; 1959, ETECSA and Radio Marti Research Department.

<sup>74</sup> Havana population is extrapolated from 1953 (785,455).



Cuba's ratio of teledensity<sup>75</sup> in the largest city to the overall teledensity (2.29) is now below the average (2.79) for lower-middle income nations (Table 38). Since the entire island is poorly served, that differential is probably explained by the values and emphasis of the government after the revolution. It was a revolution against Havana, not from Havana. Although dilapidated today, the rich architecture of the capital is a reminder of the gap between the Havana elite and rural poverty at the time of the revolution.

Cuban telecommunications infrastructure lags behind much of the world and the Caribbean region. Cuba has fewer telephone lines as a proportion of population than any large Caribbean nation except Haiti, and is closer to the low income nations of the world than the lower-middle group in which it otherwise falls.

Not only is there little infrastructure, what is there is obsolete and in ill repair. In 1995,<sup>76</sup> only 3 percent of local main lines connected to digital central offices. Faults per 100 lines doubled between 1992 and 1995, and the number of working pay phones dropped from 10,003 to 6,030 during the same period. An estimated 40 percent of the central office equipment was installed in the 1930s and 1940s, and the equipment comes from vendors in Eastern Europe, Western Europe, and North America.<sup>77</sup>

Table 38.<sup>78</sup> Cuban Telephone System Relative To Income Groups and Caribbean Nations With More Than 1 Million Population, 1995<sup>79</sup>

Nation	GDP (US\$B)	Population (M)	Main Lines (000)	Teledensity	Main Lines/ US\$M GDP	CAGR 1990-5	Percent digital	Teledensity in largest city
Cuba	18.4	11.0	353.2	3.21	19.20	2%	3%	2.29
Dominican Republic	10.4	7.8	569.0	7.29	54.71	9%	37%	1.80
Haiti	1.8	7.2	60.0	0.84	33.33	4%	94%	2.79
Jamaica	4.2	2.5	291.8	11.53	69.48	21%	100%	1.99
Puerto Rico	35.8	3.6	1,195.9	33.22	33.41	3%	100%	1.32
Trinidad and Tobago	4.8	1.3	209.3	15.98	43.60	4%	100%	0.83
Low-Income Nations	1,157	3,232	64,032	1.98	55.34	25%	90%	3.32
Lower Middle	1,653	1,133	103,028	9.09	62.31	7%	43%	2.46
Upper Middle	2,258	481	69,838	14.51	30.93	6%	65%	1.75
High Income	20,800	856	455,203	53.16	21.88	3%	78%	1.08
World Average	25,868	5,703	692,101	12.14	26.75	4%	73%	2.88

The poor condition and slow growth of the telephone system reflects the difficulty of attracting capital in a socialist economy and Communist country that is actively opposed by the United States. Like many other nations, Cuba decided to privatize telecommunications in order to attract

<sup>75</sup> Teledensity is main lines per capita, and main lines are telephone lines connecting a customer's equipment (e.g., telephone set, facsimile machine) to the public switched telephone network and that have a dedicated port on a telephone exchange.

<sup>76</sup> *World Telecommunication Development Report (WTDR)*, 3rd ed., 1996/97 (Geneva: International Telecommunications Union, March 1997)

<sup>77</sup> Lila Haines, "Cuba's Telecommunications Market," *Columbia Journal of World Business*, 30 (Spring 1995), pp. 50-57; Enrique Lopez, telephone interview (August 1995).

<sup>78</sup> WTDR, *op. cit.*

<sup>79</sup> GDP figures are for 1994.

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capital for modern infrastructure. Proposals for joint venture partners were invited in 1993, and in June 1994, ETECSA was formed. ETECSA was a joint venture between the Ministry of Communication (51 percent) and Grupo Domos of Mexico (49 percent). Domos committed to invest \$1.5 billion. In April 1995, Domos sold 25 percent of their interest to *Societa Finanziaria Telefonica, p. a.* (STET), an Italian state-owned telecommunications holding company, for \$291.2 million.<sup>80</sup> As of late 1995, very little progress had been made on the modernization of Cuban telecommunications,<sup>81</sup> and it was rumored that Domos was seeking other investors (including AT&T at the time).<sup>82</sup>

Due in part to the collapse of the Mexican peso and pressure after the Helms-Burton Act passed, Domos failed to raise additional capital. This, coupled with poor management, resulted in its being in default on the investment required under its agreement with ETECSA, and it lost its equity.<sup>83</sup> As of February 1997, STET controls 29.29 percent of ETECSA, the Cuban government 49 percent, and a coalition of banks the remainder.<sup>84</sup>

The new investment and increased level of control by STET seem to have had a positive effect. By 2004, ETECSA plans to increase the number of lines per 100 inhabitants to 20 in Havana, 10 in provincial capitals and principle cities, and 9 nationwide.<sup>85</sup> All cities over 500 people will have service, including a phone for local government, the local doctors, and public phones. This will be the case even in the mountainous regions.

Public telephones are being installed in news stands and other centers, and others are being replaced. The goal is to have 50,000 public phones by 2004. Today there are 50,000 lines in the private switchboards of organizations, which are to increase to 200,000 by 2002.

The plan is ahead of schedule, and ETECSA now hopes to meet these goals by 2002 instead of 2004. A fiber optic cable ring has been completed in Havana, and at least two digital switches installed since 1995. STET's new presence is palpable—STET officials are living in Havana, and there are many ETECSA panel trucks in the city. In 1995, one barely saw any new vehicles from the phone company or any other organization.

STET also plans a national digital backbone of microwave radio relays and fiber optic cable. The current backbone is analog microwave, and is saturated. STET is also working on a National Data

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<sup>80</sup> STET is currently owned by the Italian Government, but is being privatized. It is the world's fifth largest telephone company in terms of revenue, and controls 4 million fixed and 300,000 mobile telephone lines in Latin America and the Caribbean. It owns significant shares in the telephone companies of Brazil, Cuba, Argentina, Bolivia, Chile, and Venezuela, and 25 percent of IMPSAT. In 1997, STET formed a joint venture with AT&T to develop the Latin-American telecommunications market. (AT&T has holdings in 15 Latin American and Caribbean nations). This joint venture does not include Cuba.

<sup>81</sup> L. Press, "Cuban Telecommunications....," *op. cit.*

<sup>82</sup> The Cuban Democracy Act, in force at that time, was ambiguous on the legality of U.S. companies investing in telecommunication within Cuba. That ambiguity was subsequently cleared up by the Helms-Burton Act, which explicitly prohibits such investment.

<sup>83</sup> *Economic Eye On Cuba*, US-Cuba Trade and Economic Council (30 June 1997), <<http://www.cubatrade.org/eyeona.html>>.

<sup>84</sup> Osvaldo Bebelagua, interview. The bank share may be based on loans rather than ownership because it is also rumored that the Cuban government is considering sale of shares to other companies, including Sherritt International of Toronto, a major Cuban investor. ETECSA is profitable, so the government may decide to retain the shares held by Grupo Domos, but this would presumably slow modernization.

<sup>85</sup> José Carreno, talk at *Info '97*, Havana (October 1997) and in an interview with the author.

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Transmission Network (NDTW). The six main nodes will be in Havana, Pinar del Rio, Santiago de Cuba, Camaguey, Holguin, and Santa Clara. Secondary nodes will branch from the main nodes to adjacent provinces. The links to the main nodes are now in the testing stage and nearly completed. At least some of these links will employ Alcatel equipment capable of operation at 155 Mbps which will be run at 35 Mbps initially.

The NDTW will initially use X.25. There has been some debate on this choice (for example, at the *Ariadna* Networking Conference in May, 1996). ETECSA realizes that X.25 is old technology, but argues that there is much X.25 equipment and expertise in Cuba today.<sup>86</sup> The equipment they are installing is faster than that used in RENACYT and other early Cuban X.25 networks, and it will support IP encapsulation (albeit inefficiently). By the year 2000, ETECSA also hopes to be offering Frame Relay service in some areas. ETECSA will run IP over Frame Relay at 2 Mbps, and install servers at provincial nodes. (This sounds like it could evolve into entry into the Internet service market—for example, the hosting of Web sites on those servers.)

It is not clear to what extent the NDTW and the X.25 network being deployed by GET overlap or are the same. GET may be a customer of the NDTW, may be deploying their own infrastructure, or a mixture of both.

### *Difficulty Attracting Capital*

Cuba is just beginning to recover from the devastating effects of the loss of most of its Communist Bloc trade and the loss of Soviet subsidies in sugar and oil trade. That, in conjunction with the U.S. embargo and the reluctance of capitalists to invest in a Communist state, has made it difficult for Cuba to attract capital.

These drawbacks are mitigated to some extent by education level and good health of the Cuban work force. Foreign enterprises do not hire workers directly, but contract with the state for employees. The government receives a payment of US\$300-500 per month for a skilled worker, and the employee is paid in pesos, but almost always receives a dollar bonus in goods or cash.<sup>87</sup> Within the free trade zones, firms are permitted to have the terms of the bonus payments included in each employment contract.

Thus the government imposes a tax on employment, and probably also regulates many aspects of employee relations and policy, which may discourage investors. On the other hand, the government assumes much of the responsibility for educating, feeding, and housing the employees, and a healthy, well-educated work force is attractive to investors. While this arrangement may produce some market inefficiency, it has the socially valuable effect of insulating the necessity economy from the luxury economy, and in the long run, may turn out to give Cuba a relative advantage.

Regardless of the long run, economic difficulty has made computers, telecommunications equipment, international telephone links, software, and networking equipment, expensive during the years of rapid Internet expansion in other nations. Even when scarce capital was available, proposals for funds for Internet connectivity were met with the argument that the money was

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<sup>86</sup> Cuban experience with X.25 networking was developed for scientific communication with the Soviet Union. Cuba's Center for the Investigation and Study of Teleinformatics (CIDET), developers of RENACYT, designed and manufactured their own X.25 PADs and switches, and Foster reports that this was a source of some pride and status. See Foster, *op. cit.* ETECSA currently operates CubaNet, an older X.25 network offering commercial service, primarily to the tourism industry. See Press and Armas, *op. cit.*

<sup>87</sup> *Economic Eye On Cuba, op. cit.*

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needed for necessities like medicine. More than other nations, Cuba's limited networking capital has been used for training and investment in internal capability rather than the equipment, communication links, and service charges required for international Internet connectivity.

### *Cultural Values*

Cuba has moved slowly out of concern for the preservation of the values of the nation. This has limited pervasiveness, and may have been a consideration in the decision to consolidate connectivity in CENIAI.

Many nations share Cuban concern over the erosion of cultural values by communications media, including the Internet. Concerns and regulations on the use of local languages and pornography are common in many nations, and these are present in Cuba as well.

However, Cuba is further concerned because of its socialist economy and political philosophy. CITMA Minister Rosa Elena Simeon stated that Cuba must learn how to "use the Internet's capabilities and advantages while reducing its risks and disadvantages as much as possible. ... The First World uses the network to introduce viewpoints that work to the detriment of the ethical and cultural values of developing nations."<sup>88</sup> With the fall of Soviet Communism, there is a fear that the achievements of the Cuban revolution may be at risk. A Cuban slogan points out that there are 200 million homeless children in the world, and none of them are in Cuba. Cuba has observed the rapid commercial domination of the Internet,<sup>89</sup> and commercial values often conflict with those Cubans wish to protect.

The revolution is still present in Cuban consciousness, and there is awareness and frequent reference to its achievements: improved education, health care, and equality. These achievements are recognized by a substantial portion of the public.

### *Centralized Planning*

Cuban networking has also been delayed in order to settle the responsibilities of various networking institutions. This cautious decision making process is shaped by the Communist Party and centralized economy, and has delayed the diffusion of the Internet and the building of organizational infrastructure. Without a market to allocate resources, the government must decide on investment levels and assign tasks.

Large decisions like whether to connect to the Internet or who should be responsible for doing so are not made by a single body or according to a simple procedure: they emerge over time out of the activity of the entire government. The extent to which these decisions are influenced by power struggles among organizations and people rather than objective evaluation and decision making is unknowable—there is doubtless a mix of both.

Cuban computing dates back to the early 1960s.<sup>90</sup> In 1963, there were only three computers in Cuba. In 1964, the Center of Industrial Automation was formed within the Ministry of Industry<sup>91</sup>

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<sup>88</sup> Dalia Acosta, *Cuba-Communications: Government Wary of Internet*, Inter Press Service, Havana (30 January 1996).

<sup>89</sup> Lary Press, "Will Commercial Networks Prevail in Developing Nations?," *OnTheInternet* (March/April 1997), pp. 40-41.

<sup>90</sup> MOSAIC Group, *Cuban Informatics 1992...*, *op. cit.*

<sup>91</sup> In 1965, this ministry split into five new ministries, including the Ministry of Sugar, which remains interested in networking today.

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to work on sugar industry automation, and the Ministry of Communication established the Central Communication Laboratory for data communication research. The Ministry of the Interior was also involved with automated data processing. In 1968, a “Calculation Plan” was made, and in 1969, a decree of Fidel Castro established the University of Havana Center for Digital Research (the organization preceding GET) to build Cuban computers. They built a series of computers based on others’ designs, including microcomputers in the 1980s.

CENIAI was founded in 1983 with three people; it grew to 80 by 1989, but was down to 62 in 1992. CENIAI and IDICT were part of the Academy of Science until AID was formed in 1994. More recently, CITMA moved the organization containing RENACYT to AID.

In April, 1991, the Office of the Ideological Secretary of the Central Committee of the Cuban Communist Party (Carlos Aldana) approved the establishment of an e-mail connection between Cuba and Canada,<sup>92</sup> opening the way for UUCP e-mail to the Internet and participation in Usenet newsgroups. By 1992, CENIAI, Infomed, TinoRed, and CIGB all had international UUCP links.<sup>93</sup> By 1995, each of these networks had expanded significantly, and were connecting other networks.

Cuba also built technical expertise with UUCP and IP networking during this time. For example, a CIGB staff member attended and subsequently was an instructor in the Internet Society Developing Nations Workshops, and CIGB hosted an IP Technology Workshop in Havana in 1995. Practical experience played an even more important role than study. Faced with severe shortages of money and information, Cuban engineers were forced to be resourceful and patient. When asked how he began working with Ethernet LANs, an Infomed engineer remarked that he “got two Ethernet boards, a piece of coaxial cable, and began experimenting.”

While budgets and the poor telephone infrastructure restricted Cuba (and other developing nations) to UUCP networks at first, engineers realized that IP networking was standard in developed nations, and CENIAI and CIGB began experimenting with IP. CENIAI had proposed IP connectivity in 1993.<sup>94</sup> In 1994, CIGB obtained a Class C Internet address, and in January, 1995, CENIAI obtained a Class B address (169.158).

It was clear that there was considerable demand for connectivity and enthusiasm in the networking community, but it was too important to be left to engineers. A CENIAI official estimated that there were approximately 3,000 e-mail accounts in October 1997. This indicates little or no growth during the last two years—political considerations slowed development.

Still, the value of the Internet became increasingly clear. The Cubaweb Web site was established by GET in Canada, demonstrating that business could be generated and that information flowed both ways on the Internet. Infomed received funding, and expanded their network from Havana to the provinces. At the Fifth Plenum of the Central Committee of the Communist Party of Cuba, 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

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<sup>92</sup> “Cuba’s Access to Worldwide Information Networks Approved,” *Granma* (3 July 1996).

<sup>93</sup> Press and Snyder, *op. cit.*

<sup>94</sup> Jesus Alfonso Martinez, *Desarrollo de la Iniciativa Cubana Red CENIAI del al Academia de Ciencias de Cuba*, III Foro de Redes Academicas de la America Latina y El Caribe, Caracas, Venezuela (17-22 October 1993).

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position [to face the challenges of such scientific and technological changes], due to the educational and scientific work developed by the revolution.”<sup>95</sup>

In May, 1996, CITMA held the *Ariadna* '96 National Congress on Telematics,<sup>96</sup> bringing together the Cuban networking community. Over 400 people tried to register for the conference, but only 280 were able to attend due to space limitations. The organizing committee was chaired by Jesus Martinez, Director of CENIAI, and six of the 14 committee members came from IDICT organizations. The remainder of the representatives came from ICIMAF (now under AID), *Instituto Superior Politécnico “José Antonio Echeverría”* (ISPJAE), CIGB, Infomed, GET, the Center for Design of Automated Systems, and SEGURMATICA. The conference included plenary sessions by people from CIGB and Infomed, and IDICT, RENACYT, Infomed, and GET were among the seven exhibitors. GET demonstrated Web access over a 9.6 Kbps SLIP connection to New York. This exhibit was very popular, and was probably most attendees' first viewing of a graphical Web browser accessing an Internet server. It is noteworthy that ETECSA was not represented, though an ETECSA engineer did deliver a talk in which he discussed ATM as a future possibility.

While *Ariadna* was the first networking conference, it should be noted that SIME, with UNESCO support, has hosted *Informatica*, an important biannual conference (actually a collection of independent technical conferences) and trade show, since 1988. *Informatica* '92 and '94 are discussed in Press.<sup>97</sup> *Informatica* '96 had 11 technical conferences with 503 papers and was attended by over 450 foreign delegates from 39 nations and over 900 Cubans.<sup>98</sup> The trade show had exhibits from 216 firms (92 foreign), and was attended an estimated 15,000 people.

The *Informatica* '98 organizing committee is presided over by SIME staff with collaboration on the technical and program committee from others, including the Ministry of Higher Education, CITMA (CENIAI and the Center for Design of Automated Systems), and representatives of the Federation of European Multimedia and the University of Colima, Mexico. *Informatica 2000* will be organized by CITMA and moved from the Convention Center to the capital building which CITMA is refurbishing as a meeting center.

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. An Inter-ministerial Commission to regulate access and manage networking was established. The commission represents five ministries, CITMA, Communications, Interior, Justice, and the Armed Forces, and is presided over by SIME. Thus, the parent organizations of CENIAI, GET, and ETECSA are represented on the Commission, and Interior, Justice, and the Armed Forces are present to represent interests of national security, political control, and protection of values and culture.

These interests are reflected in the charge that the Commission develop policies and a strategy consonant with Cuba's culture, development needs, and the interests of “national defense and

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<sup>95</sup> “Cuba's Access...,” *op. cit.*

<sup>96</sup> There were six conference tracks: Network security and administration, Network applications, LAN, MAN, and WAN Networks, Information and value-added services, Technology of network interconnection, and Other Themes. This summary of *Ariadna* is based on Foster, *op. cit.* Foster attended the conference.

<sup>97</sup> Press, “Cuban Telecommunications...,” *op. cit.*

<sup>98</sup> <<http://206.130.183.226/infor98.html>>.

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security.”<sup>99</sup> The Commission is responsible for tracking technological change and “coherent behavior of the various central state administrative agencies” in order to conserve scarce resources. The decree states that it is necessary to insure that information transmitted from Cuba is truthful and the information Cuba receives is “in accordance with Cuba’s ethical principles and not harmful to the country’s interests and security.” Network access priority is given to “institutions considered the most significant in the country’s life and development” and, for now, only legally recognized enterprises and institutions, not individuals, will have access. Cuban officials point out that the latter point is moot in this period of scarce resources since few private individuals have computers or can afford Internet accounts.

In September 1996, Jesus Martinez e-mailed an announcement of CENIAI’s connection to the Internet; in October it was operational; and by February 1997, the administration of the .cu domain had been transferred from Canada to CENIAI.<sup>100</sup> As far as Web/NIRV and GreenNet know, there are no longer any UUCP feeds to Cuba, which means that international traffic is centralized through CENIAI.<sup>101</sup> This produces economies of scale in operation, and also facilitates control over access and content.

In November, 1997, the Inter-ministerial Commission was to have published a Strategic Plan for Information.

It seems that Cuba decided to link cautiously to the Internet, but will continue to stress internal connectivity. Even if international connectivity and bandwidth had been more affordable, the strategy of investing internally, in computers, networking equipment, telecommunications infrastructure, and most importantly, in human capital—networking technicians and trained, demanding users—would have been quite reasonable. Where they need bandwidth, for example in marketing tourism, they simply establish a server in North America.

It appears that the major Internet implementation ministry is CITMA, with AID, but SIME is represented by GET, and the Ministry of Communication by ETECSA. GET has been more aggressive in using servers in North America. Other ministries are overseeing the impact of the Internet, and security and control over access and content are still high priorities, relatively easy to assure with the centralization of international connectivity at CENIAI. Singapore-style Web proxies, e-mail filtering, and firewalls would be relatively simple to implement, especially with today’s low levels of traffic.

### *Protecting Embargoed Business Activity*

A major concern of the Inter-ministerial Commission was that information about Cuba’s trading partners would leak out over the Internet to the United States and be used to tighten the embargo.<sup>102</sup> Indeed, there is already considerable third-party information concerning organizations and nations trading with and investing in Cuba. For example, the U.S.-Cuba Trade and Economic Council reports that an estimated 4,500 companies have been cited in the international media as having or discussing commercial activities with enterprises within Cuba,<sup>103</sup> and they list three

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<sup>99</sup> Quotes from Decree 209 are from Valdez, *op. cit.*

<sup>100</sup> Archives with the messages announcing these milestones are found at the Internet Start-Up Resources Center, <<http://www.nsrc.org/>>.

<sup>101</sup> There may be some corporations with proprietary links or links operated by security forces.

<sup>102</sup> Foster, *op. cit.*

<sup>103</sup> U.S.-Cuba Trade and Economic Council, *Non-United States Companies and the Republic of Cuba*,

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pages of examples of major Latin American and European companies. They also state that foreign investment of US\$5.901 billion has been announced and US\$1.246 billion committed or delivered between 1990 and 10 October 1997.<sup>104</sup>

### *Propaganda*

Cuba has lived with Radio and TV Marti for many years, and has used scarce resources in an attempt to jam them.<sup>105</sup> They do not allow the free flow of information from, to, or within the nation, and the fear that the Internet may lead to greater freedom of expression and thought has caused resistance to it.<sup>106</sup> At the same time, there is recognition that the Internet can be a source of economic productivity, improved health care, education, and quality of life. This presents a “dictator’s dilemma”<sup>107</sup>—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 keeping them from political information?

Cuba has experienced Internet propaganda. For example, in the Fall of 1993, the U.S. Interest Section in the Swiss Embassy in Havana obtained an account on TinoRed, enabling them to send e-mail to many Cuban accounts.<sup>108</sup> They used this to send material about the United States and U.S. government policy on Cuba to lists of Cubans. This was no more welcomed by the Cuban government than Radio or TV Marti broadcasts, and the account was canceled. In 1994, lists of Cuban e-mail addresses became available, and unsolicited anti-government material was sent to many people in Cuba.<sup>109</sup> Such messages were seen as a threat, and efforts were made to block them.<sup>110</sup> At the time, Cuban colleagues stated that such actions put Cuban networking at risk. On 30 June 1994, the Ministry of Communication issued a resolution intended to centralize all networking activities.<sup>111</sup> Cuba is also aware of the existence of anti-Castro web sites like that of the Cuban American National Foundation (CANF).

At the same time, the Internet offers Cuba a propaganda opportunity—it is home to the Cuba Solidarity web site as well as the CANF site. Table 39 shows a selection of Cuban-controlled sources of political information on the Internet.

Still, one must question the propaganda value of the Internet for either side.<sup>112</sup> The Cuban revolution is nearly 40 years old, so opinions are rather set on both sides. Cuba has made skillful

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<<http://www.cubatrade.org/nonus.html>>.

<sup>104</sup> \_\_\_\_\_, *Foreign Investment in Cuba*, <<http://www.cubatrade.org/foreign.html>>.

<sup>105</sup> Press, “Cuban Telecommunications...,” *op. cit.*

<sup>106</sup> Kedzie has analyzed the correlation between Internet connectivity and democracy, and argues for a degree of causality in both directions. Christopher R. Kedzie, “Democracy and Network Interconnectivity,” *Proceedings of INET '95, International Networking Conference*, Honolulu, HI, (Reston, VA: Internet Society, August 1995). As early as 1992, Gonzalez and Ronfeldt suggested a U.S. policy of using computer networks for communication with Cuban individuals and NGOs (though they saw this as a potential two-edged sword). Edward Gonzalez and David Ronfeldt, *Cuba Adrift in a Postcommunist World*, R-4231-USDP, (Santa Monica, CA.: RAND Corporation, 1992).

<sup>107</sup> Press, “Cuban Telecommunications...,” *op. cit.*

<sup>108</sup> “Cuba’s Access...,” *op. cit.*

<sup>109</sup> Steve Cisler, *Our LAN in Havana*, <<http://home.inreach.com/cisler/havana.html>>.

<sup>110</sup> “Cuba’s Access...,” *op. cit.*

<sup>111</sup> *ibid.*

<sup>112</sup> We agree in our assessment with Edward Gonzales, *System Change and the Information Revolution in Cuba*, DRR-1748-OSD (Santa Monica, CA: RAND Corporation, October 1997), who points out that “[g]iven the



use of their tightly controlled radio, television, and press, and a charismatic leader to form public opinion during that time. One wonders how effective a low-bandwidth medium like today's Cuban Internet could be in swaying that opinion.<sup>113</sup> It is likely that the brief period during which many Cubans had access to uncensored American TV programs and commercials via now-banned satellite dishes<sup>114</sup> may have had a more profound impact on Cuban public opinion than years of e-mail would.

*	Granma International	<a href="http://www.cubaweb.cu/granma/">http://www.cubaweb.cu/granma/</a>
*	Granma International	<a href="http://www.granma.cu/">http://www.granma.cu/</a>
*	Granma Nacional	<a href="http://206.130.183.236/">http://206.130.183.236/</a>
*	Juventad Rebelde	<a href="http://www.cubaweb.cu/jrebelde/">http://www.cubaweb.cu/jrebelde/</a>
*	Juventud Rebelde	<a href="http://206.130.183.221/">http://206.130.183.221/</a>
*	Prensa Latina	<a href="http://www.prensa-latina.org/">http://www.prensa-latina.org/</a>
*	Radio Havana Cuba	<a href="http://www.radiohc.org/">http://www.radiohc.org/</a>
*	Trabajadores Digital	<a href="http://206.130.183.217/">http://206.130.183.217/</a>
	Cubavision (TV)	<a href="http://www.ceniai.inf.cu/CUBAVISION">http://www.ceniai.inf.cu/CUBAVISION</a>
	Habanera Magazine	<a href="http://www.ceniai.inf.cu/HABANERA">http://www.ceniai.inf.cu/HABANERA</a>
(* = Server is in North America.)		

The Gallup Poll referred to earlier found Radio Marti broadcasts much more popular among the 23 percent alienated from the government than among those who were disengaged or pro-government. Forty-three percent of the alienated group mentioned Radio Marti as one of the three stations they have listened to most frequently during the prior two months, while only five percent of the pro-government respondents and nineteen percent of the disengaged had. Similarly, it is difficult to imagine the Cuban Solidarity web server having an impact in the anti-Castro community in Miami.

Global experience shows that the commercial value of the Internet far exceeds its propaganda value. To date, Cuba's primary external Internet application has been selling tourism. It is difficult to judge the contribution of Web servers to steadily-increasing Cuban tourism, but Web sites as popular as Cubaweb must easily cover their costs,<sup>115</sup> and Cuba has wisely chosen not to

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absence of most of the essential preconditions and change accelerators that were present in the former Soviet Union and China, the information revolution is not likely to hasten the process of change and open up Cuba in the near future." (p. viii) and "[f]or the most part, U.S. [information] policy can at best work only at the margins." (p. 96).

<sup>113</sup> Even in developed nations, the Internet reaches relatively few people and at low speed. Its value as a propaganda tool may be enhanced once high-bandwidth connectivity becomes ubiquitous, but Singapore is the only nation where that goal seems likely within the decade.

<sup>114</sup> These underground dishes received CNN, MTV, and other broadcasts intended for tourist hotels. A Cuban colleague estimated that there were at least 100,000 of these, and they were visible all over Havana. They were banned in 1994.

<sup>115</sup> An analysis of tourist Web activity and revenue would be of great interest to other nations, but would have to come from Cuba.

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jeopardize that asset with blatant propaganda. On both sides, Internet propaganda is low-bandwidth preaching to the choir.

*Threat of use by subversive organizations*

There may be cases in which the Internet has more propaganda impact than in Cuba, for example, in support of the Zapatista up-rising in Chiapas, Mexico,<sup>116</sup> where events are relatively recent, and news comes directly from the principles without mediation; however, the logistical use of networks by politically hostile organizations appears to be perceived as a bigger threat, and may have led to the loss of NGO e-mail accounts.

This logistical use may occur during a crisis as, for example, during the Soviet coup attempt, when the Internet (Usenet newsgroups) brought information into and out of the Soviet Union and circulated information within.<sup>117</sup> The information coming in had no value as propaganda, but did inform the people receiving it<sup>118</sup> of world opinion, and they could know they were not alone. For example, Polina Antonov, who handled much of the Soviet communication during the coup attempt, wrote, “maybe you’d write me ‘what do they say on your TV about the situation, as we can’t watch CNN now.’ ... They try to close all mass media, they stopped CNN an hour ago, and Soviet TV transmits opera and old movies.” Afterwards she wrote, “You can’t even imagine how grateful we are for your help and support in this terrible time! The best thing is to know that we aren’t alone.” Another Russian posted the following to a news group: “When the dark night fell upon Moscow, Relcom was one source of light for us. Thanks to these brave people we could get information and hope.”

Even more important, was logistical information circulating within the Soviet Union, for example this message from Nizhniy Novgorod: “Yesterday at 17:00 a rally in support of Yeltsin was held; regional deputies participated. Today at 17:00 there will be a rally in the city center where a strike committee will be formed. ... The atmosphere is calm in the city, there are no troops to be seen.”

Note that this was UUCP traffic over dial-up telephone lines, which would have been difficult to detect and stop had the authorities wished to do so. When asked about the danger of detection, Polina wrote “Yes, we already prepared to shift to underground; you know—reserve nodes, backup channel, hidden locations. They’ll have a hard time catching us!” They also began using portable computers, and Polina wrote “Don’t worry; the only danger for us is if they catch and arrest us, as we are sitting at home (Valera is at Demos)<sup>119</sup> and distributing all the information we have.”

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<sup>116</sup> David Ronfeldt and Armando Martínez, “Comentarios Sobre la Guerra de Rad Zapatista” (“A Comment on the Zapatista Netwar”), in Sergio Aguayo Quezada and John Bailey (coords.), *Las Seguridades de México y Estados Unidos en un Momento de Transición* (Mexico City: Siglo Veintiuno Editores, 1997), pp. 320-346.

<sup>117</sup> The quotes in this section are from messages sent to the author by Polina Antonov, an employee of the Relcom network who was active in e-mail communication during the coup attempt. These quotes and others appear in L. Press, “Relcom, An Appropriate Technology Network,” *Proceedings of INET’ 92*, International Networking Conference, Kobe, Japan (Reston, VA: Internet Society, June 1992). Reprinted in *The Proceedings of the Telecommunications Conference*, Moscow, Russia (June 1992).

<sup>118</sup> There is no way of knowing the numbers of people seeing this information at the time. It is safe to say that it would be much higher in Russia today, and would reach a significant number of people in a richly-connected nation such as Finland.

<sup>119</sup> Demos was the organization which operated Relcom, and Valera, Polina’s husband, also worked at Relcom.

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Even without a crisis situation, NGOs were seen as potentially subversive. In March 1996, Raul Castro stated:<sup>120</sup>

[T]he enemy does not conceal its intention to use some of the so-called non-governmental organizations 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 American scholar Gillian Gunn:<sup>121</sup>

*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.

A Cuban official corroborated this concern over the role of hostile NGOs in the downfall of the USSR. He also cited the Helms-Burton Act as encouraging NGOs within Cuba to work toward democracy-building and turning out the Castro government, since section 209 of the act authorizes the President “to furnish assistance and provide other support for individuals and independent non-governmental organizations to support democracy-building efforts for Cuba.”<sup>122</sup> The Act directs the president to “take the necessary steps to encourage the Organization of American States to create a special emergency fund for the explicit purpose of deploying human rights observers, election support, and election observation in Cuba,” and the President is directed to provide “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.”

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<sup>120</sup> Raul Castro, “The Political and Social Situation in the Country and the Corresponding Tasks of the Party,” Speech, Fifth Plenum of the Central Committee of the Communist Party of Cuba, Havana (23 March 1996), reproduced in *Granma Internacional* (10 April 1996).

<sup>121</sup> Gillian Gunn, *Cuba’s NGOs: Government Puppets or Seeds of Civil Society*, Cuba Briefing Paper Number 7, Haiti-Cuba Project (Washington, D.C.: Georgetown University, February 1995).

<sup>122</sup> The Act does not explicitly mention the Internet as a medium for support. It lists “Published and informational matter, such as books, videos, and cassettes, on transitions to democracy, human rights, and market economies, to be made available to independent democratic groups in Cuba.”

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While Cuba has allowed the Internet to progress, it has done so carefully. Users must be authorized, and nearly all access is through work.<sup>123</sup> Many NGOs had Cuban e-mail accounts in 1995. Press lists 31 such organizations.<sup>124</sup> These were connected through Red David, which linked internationally through TinoRed, but it appears that TinoRed is no longer providing accounts to the Red David NGOs. Infomed regulates access and content.<sup>125</sup> Infomed accounts may not be used by third persons or for lucrative or personal purposes. Information distributed on the network must be relevant to the objectives of MINSAP and the network and in accord with revolutionary principles. Users, their institutions, and network administrators are responsible for reporting transgressions if they are discovered.<sup>126</sup>

These changes and restrictions could have been motivated by economics, political concerns, or most likely, a mixture of both. Similarly, all international traffic is now carried by CENIAI, whereas CENIAI, Infomed, TinoRed, and CIGBnet all had international UUCP links in the past. While this makes economic sense, it also provides a single point of control for content or access. It also facilitates efforts to guard against hackers attempting to steal or corrupt information.

#### *Non-Commercial Orientation*

In most, but not all nations,<sup>127</sup> the Internet begins with academic and research networks. These are typically eclipsed by commercial networks, which rapidly attract capital, enabling the more rapid diffusion of the Internet.<sup>128</sup> Cuban networking also began in research (CENIAI was at that time a part of the Cuban National Academy of Science), but has not moved to a phase of rapid commercial growth. As such, the *sectoral* absorption balance is atypical, with relatively little private or commercial networking. This emphasis reflects both the values of a communist state and difficulty in capital formation.

As seen in Table 40, the *.com* and *.net* domains are growing faster than other generic top-level domains. While there is commercial activity in Cuba (most visibly, the external Web sites), the primary purposes of Infomed, TinoRed, and CIGBnet are improved health care, education, and research. Even Teledatos, which began as a tourist network, is now working with ETECSA on infrastructure, and is connecting ministries and provincial governments.

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<sup>123</sup> User authorization is moot today since very few Cubans can afford a computer and network account.

<sup>124</sup> Press, "Cuban Telecommunications..." *op. cit.*

<sup>125</sup> Minister of Health, *Reglamento Interno para el Funcionamiento de la Red Y Codigo de Etica Interno* (29 December 1997).

<sup>126</sup> This is reminiscent of debates in the United States and other nations as to whether ISPs should be held accountable for user behavior.

<sup>127</sup> For example, the Soviet Relcom network was open to business from its inception; however, university and research networks led in virtually all Latin American and Caribbean nations, due in part to an effective network seeding program by the Organization of American States, with assistance from the U.S. National Science Fund.

<sup>128</sup> Press, "Will Commercial Networks Prevail..." *op. cit.*

Domain	January 1995	July 1997	Increase	
.com	1,316,966	4,501,039	3,184,073	242%
.net	150,299	2,164,815	2,014,516	1340%
.edu	1,133,502	2,942,714	1,809,212	160%
.mil	175,961	542,295	366,334	208%
.org	154,578	434,654	280,076	181%
.gov	209,345	418,576	209,231	100%
.int	904	724	(180)	-20%
Total	3,141,555	11,004,817	7,863,262	250%

The opening ceremony of the *Info '97* Conference in Havana was illustrative of Cuba's emphasis. The keynote address was given by Osvaldo Bebelagua, AID President. Bebelagua opened his address with a poem, then 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 a chamber music performance. An American computing conference would not begin with such a keynote. It would be optimistic and probably product-oriented, with no time for ambivalence, poetry, or chamber music. Although he is clearly concerned with economic viability, Bebelagua is not as focused as Bill Gates on quarterly financial results.

This non-commercial emphasis is consistent with the expressed philosophy and policies of the Cuban government. On the other hand, it may be a transient, start-up condition, tied to hard currency opportunities. Infomed was jump-started with UNDP funds, and TinoRed with support from Fidel Castro. In the future, CIGB may invest increasingly in network support for product marketing, banking and tourism networks may rapidly outgrow Infomed and TinoRed, and their technicians may be hired away to build commercial networks and web servers; however, that has not been the case to date.

More likely we will see a different balance between commercial and non-commercial applications than in capitalist nations. There will doubtless be more commercial networking, like GET's externally-hosted Web sites, but the Cuban government will insist on non-commercial development as well. Commercialization may rapidly attract capital to networking, but, as anywhere, the Cuban network will also reflect the values of the society, even if that slows diffusion somewhat.

### *Populist History*

Cuba's history of revolution from the countryside against the established power in Havana has led to atypical geographic dispersion of networks (and telecommunications infrastructure). Network activity usually begins in one city or even one organization, and particularly in developing nations, often remains concentrated in the capital.<sup>130</sup> For example, in 29 African nations, Internet connectivity is confined to one city, and in seven others to only two (Table 41). While Havana is the hub

<sup>129</sup> Source: Network Wizards, <<http://www.nw.com>>.

<sup>130</sup> The Internet is geographically concentrated in all nations. For example, in the United States, concentration is much higher on the coasts than the interior, and regions such as Silicon Valley, New England and New York are even more dense.

city for all national networks, and the majority of resources are there, Cuban networking is atypically dispersed. This dispersion began with the telephone system. As we saw, post-revolutionary Cuba built provincial and rural telephony faster than in Havana, even though there is considerable need and demand there. The current ETECSA plan also stresses national telephony and data networking. Infomed and TinoRed were from their inception national networks.

If Cuba retains this geographic balance, we may learn something of the ability of networks to improve the quality of life. There has been massive global migration to cities during the last 30 years, and the UNDP estimates that future migration rates will be high in less developed nations.<sup>131</sup> The resulting crowding and urban poverty have been sources of social unrest and environmental disaster. These migrations are in search of education, health care, work, and fuller participation in the world. If networks can lead to improvements in rural or town life, fewer may feel compelled to move. Implicitly or explicitly, infrastructure planning is social planning.

Table 41. <sup>132</sup> African Connectivity	
Availability	Number of nations
No connectivity	7
Store-forward only	3
IP in capital only	29
IP in second city	7
IP nation wide (local dial up)	8
Total	54

Perhaps breadth of choice is at the heart of the quality of life. A rural life may be desirable if it is freely chosen, rather than imposed by necessity. Choice implies awareness, and communication technology expands horizons, making us aware of vocational, political, and value issues and alternatives. This issue is also tied to productivity—prosperous nations involve a high percentage of the population in intellectual and economic life.

### *Human Capital*

As we have seen, Cuba has concentrated on internal development rather than international connectivity. In difficult financial times, people's time is relatively more plentiful than equipment, making training a good investment. The Cuban government has also traditionally stressed education, and Cubans' literacy rate and level of education reflect this emphasis. Networks require trained technicians and trained, demanding users, and we will consider both.

Cuban networking technicians are reminiscent of the earliest days of personal computing in the United States or the early *Interop* conferences in the networking community. There is a feeling of enthusiasm, openness, resourcefulness, and purpose. Technicians are eager to talk about their work and its importance, and they have learned to improvise and be persistent. There has been some participation in international workshops and conferences, and the University of Havana and

<sup>131</sup> United Nations Development Program, *1995 Human Development Report* (Oxford and New York: Oxford University Press, 1995).

<sup>132</sup> Source: Jensen, Mike, *The Current Status of Connectivity in Africa*, December 1997, <<http://demiurge.wn.apc.org:80/africa/afstat.htm>>.

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ISPJAE have a history of involvement in data communications, but most networking technicians seem to have learned on the job.

This practical training is of course restricted by the technology in use. This hurdle is most evident in telecommunications, where experience with X.25 networks seems to be driving implementation decisions. Cuba has developed, manufactured, and used X.25 equipment for many years, but that is not the ideal technology for a new generation of technicians to learn. The required skill mix may shift substantially when more capital is available.

Limited access to hardware and information impedes learning at all levels. Time is wasted by 2,400 bps data transfers and constant re-dialing to make connections. Cuban technicians cannot log onto the Internet and download the latest version of a driver or hardware documentation, and one sees very few technical books or periodicals.

Cuba's guarded attitude toward information and lack of Internet connectivity are clear constraints in this area. They have a strong record of technical education, with 1.8 scientists and engineers per 1,000 population, 40 universities and other centers of higher education, and over 200 research and development centers,<sup>133</sup> and they devote 1.17 percent of GDP to technological research and development. However, it will be difficult to maintain traditional educational levels and quality without openness to information.

Current software is more readily available than current hardware. Each of the major networking organizations has UNIX or Windows NT system administrators, database technicians, and Web developers. In 1992, we were struck by a lack of sophistication in software user interfaces and development technique,<sup>134</sup> but the situation seems to have improved somewhat. There are many machines running Windows 95 in the networking organizations, and current versions of development tools and software packages are readily available; however, the installed base is still primarily DOS PCs.

The Youth Computer Clubs, described above, are a uniquely Cuban organization for computer literacy and user training. They are geographically dispersed and free of charge, and they offer unstructured access to computers and software as well as traditional classes.

While this is admirable, user training on the job or in the home is limited. Few people have access to computers at home or work. Network access is also limited. People are not allowed private accounts. Access at work is uncommon, and when present, it is typically for e-mail only and via a shared account. Such controlled access keeps users from experimenting and learning by doing.

## **Problems and Prospects**

The following are several summary and concluding observations.

### *Cuban Networks and Telecommunication*

- Cuba's international Internet connectivity began with an unreliable UUCP link between CENIAI and Canada in 1991, grew to four active UUCP links (CENIAI, Infomed, CIGBnet, and TinoRed) by 1994, and was consolidated in a single IP link between CENIAI and the

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<sup>133</sup> One wonders how many of these institutes and centers will be able to make the transition to self-sufficiency.

<sup>134</sup> Press and Snyder, *op. cit.*

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United States in late 1996. Cuba's international Internet connectivity is meager compared to its internal networks and by the standards of Latin America and the Caribbean.

- Today, there are four networks that provide connectivity for others: CENIAI, Teledatos, RENACYT, and Infomed. CENIAI operates the IP link, and connects many networks. Teledatos serves the tourism industry and others, and operates North American Web servers. Infomed still connects other networks, but concentrates on the health community. RENACYT provides many internal connections, but is hampered by X.25 technology.
- The Cuban telephone infrastructure is a major constraint on internal networking, although the Italian company STET increased its ownership share in 1997, and appears to be making some investment. The original foreign investor, Grupo Domos of Mexico, is out as a partner.
- Cuba's telephone infrastructure has been adversely affected by the trade embargo.
- Much of Cuban connectivity is based on the X.25 protocol, which is outdated and poorly suited to IP traffic, and much Cuban software is written for small, DOS-based computers. This reflects the installed equipment base and technician skill mix, but eventually Cuba will have to embrace more modern technology.

#### *Decision-making*

- After a period of ambivalence and evaluation, an Inter-ministerial Commission on Networking has been formed to oversee and control Cuban efforts in this area and to produce a strategic plan for information.
- CITMA has taken the lead in networking and related computing and publishing activities, which they have consolidated under AID. SIME also plays a major role in presiding over the Inter-ministerial Commission on Networking, and through the GET Teledatos network which supports the critical tourism industry, operates Web servers in North America, and is networking national and provincial government offices. The Ministry of Communication is involved through ETECSA, but at this time is not involved with value-added Internet services.
- Non-networking interests are represented on the Inter-ministerial Commission by the Ministries of the Armed Forces (national security), Interior (political stability and values of the revolution), and Justice (intellectual property).
- Based on their reading of the Soviet and Eastern European experience and U.S. legislation and statements, Cuba has moved to curb the network access of NGOs, which were seen as potentially subversive and susceptible to encouragement and funding from the United States.
- While the Internet does not seem to be particularly important for either the United States or Cuba as a propaganda vehicle, it may be more important as a medium for logistics and coordination.

#### *Particularly Cuban Characteristics*

- The strategy of building internal networks and skills at the expense of international connectivity was a result of political ambivalence toward networking (a desire to reap the economic and educational benefits without the political and cultural risks), the time taken to decide who would control networking, economic constraints, and a manifestation of the values of the society.



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- Cuba's traditional emphasis on education, coupled with a strategy that emphasizes the development of internal networks, has resulted in a community of enthusiastic and resourceful technicians, but they are hampered by their lack of access to modern equipment and technical information.
  - The Cuban economy has recovered somewhat, but was very hard hit by the loss of Communist trading partners and Soviet subsidies. That, coupled with the U.S. embargo and investor concern over government control and potential for expropriation, makes it difficult for Cuba to attract capital for network and telecommunication investment.
  - Economic problems and difficulty attracting capital are mitigated somewhat by Cuba's fairly well-educated labor pool; however, many lack training with current technology.
  - There are some market reforms in the IT sector, and organizations are expected to be self-sufficient by 1999. There will doubtless be some shake-out as a result. CENIAI and Teledatos appear to be the two most active networking organizations, and they compete directly in some areas. There is also limited unofficial computing and networking activity.
  - Cuban networking has not moved as quickly toward commercial domination as in other nations.
  - Cuban networks and telephone infrastructure are unusual for developing nations in the degree of emphasis placed on development outside of the capital city, and this may prove a long-run advantage.

Looking to the future, we would expect movement along the various dimensions because major decisions have now been made regarding Internet policy; however, ongoing economic problems, poor telecommunications infrastructure, political ambivalence that limits access and content, and difficulty in attracting investment will slow that movement.

*Pervasiveness* Internet access in Cuba is restricted by policy, but if that limitation were lifted tomorrow, the level of penetration would remain low. In today's economy, few Cubans could afford either computers or Internet accounts, and the telecommunications infrastructure could not support widespread access.

*Geographic Dispersion* As long as the present regime remains in power, atypical emphasis on geographic dispersion within Cuba is likely.

*Sectoral Absorption* As long as the present regime remains in power, atypical emphasis in the health, education, and government sectors relative to the commercial sector is likely.

*Connectivity Infrastructure* Connectivity infrastructure is severely constrained by the poor telecommunications infrastructure. Significant investment will be needed to modernize the infrastructure, which is not likely to occur rapidly under the current regime.

*Organizational Infrastructure* Today, networking organizations are controlled by CITMA and SIME, and CITMA seems to have taken the lead, with oversight provided by the Inter-ministerial Commission. Perhaps the most likely change is that the Ministry of Telecommunication, through ETECSA, may also become an Internet service provider. Other vendors may be invited in (possibly by these ministries) in order to attract capital.

*Sophistication of Use* It will be some time before Cuban applications become more sophisticated, as this will require greater pervasiveness.

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AID	Agency for Information for Development—The information technology umbrella agency within CITMA
APC	Association for Progressive Communications—APC was founded in 1989 to coordinate the operation and development of networks devoted to peace, ecology, human rights, and other “progressive” causes.
CENIAI	<i>Centro Nacional de Intercambio Automatizado Industria y San Jose</i> (Center for Automated Exchange of Information)—Operates the Cuban DNS and international link
CIDET	Center for Teleinformatic Research and Development—CIDET has a long history of X.25 networking
CIGB	Center for Genetic Engineering and Biotechnology—Operated one of the original UUCP links to Canada, and has a multi-city network
CITMA	Ministry for Science, Technology, and the Environment—Includes AID, ICID and CENIA, and has a major interest in networking
ETECSA	<i>Empresa de Telecomunicaciones de Cuba, S. A.</i> —The Cuban telephone company
GET	Group for Electronics in Tourism—The organization that operates the Teledatos network
ICID	Central Institute for Digital Research—Part of SIME; built early Cuban computers
ICIMAF	Institute of Cybernetics, Mathematics, and Physics—Operates RENACYT
IDICT	Institute for Scientific and Technological Information—The AID division that contains CENIAI
ISPJAE	<i>Instituto Superior Politécnico “José Antonio Echeverría”</i> —A leading technology university
MINSAP	Ministry of Public Health—Operates the Infomed network
NDTW	National Data Transmission Network—The digital network being deployed by ETECSA
RENACYT	National Network for Science and Technology—An X.25 network which provides UUCP links between many Cuban networks
SIME	Ministry of Mechanical and Electrical Industries—Has a major interest in networking; includes GET/Teledatos
STET	<i>Società Finanziaria Telefonica p.a.</i> (Italy)
YCC	Youth Computer Club—Operates walk-in computer and training centers in over 160 municipalities; many of these have UUCP connectivity

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