

# The Challenges and Rewards of the Transition to IP Telephony for Developing Nations: Central America

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## **Abstract**

*Technologies for creating, accessing and displaying information, such as for Web-based applications, rapidly advance and proliferate in the developed nations. In many countries communications infrastructures cannot provide access for much of their population to such information resources. This situation promises to widen the already considerable gap between developed and under-developed nations. Significant issues confront Central American countries, where major barriers compromise their entry into the information-centric world now emerging.*

## **IP Telephony: A Migration Path for End Users to Networked Information Services**

The term 'internet' refers to connections between ('inter') networks, in contrast to the familiar POTS (Plain Old Telephone Service) which provides voice connections between end users. Until the 1960s, the POTS infrastructure was based on analogue transmission of voiced signals. The underlying approach (frequency division multiplexing) provided a scalable network infra-structure capable of sustaining the dramatic growth of telephone services up to the 1960s. The underlying network first sets switches to establish a connection between the end users and then opens this 'channel' for their use. This 'circuit switched' network provides a natural capability for real-time transmission of continuous signals, including audio and video, between end users. By the 1960s, electronics technologies had advanced enabling a transition from analogue to digital long-haul transmission. Each voice signal received at a central office was converted to a 64 KBPS data stream. The underlying network infrastructure changed to one using high-speed transmission of data, with faster data streams capable of transmitting a larger number of voice signals. The 'circuit switched' network approach was continued in order to support real-time voice (and video).

The Internet's TCP/IP technology emerged in the 1970s. It handled data file transfers between computers. In contrast to continuous data streams such as speech, computers tend to communicate with bursts of data. The data sent by a computer in a burst is called a data packet and networks developed for such computer communications generally use packet switching. Each packet is addressed and finds its way, separately, through the network from source to destination. The late 1970s had established the current form of the Internet architecture and protocols.

Appearing only a little over 2,000 days ago, the World Wide Web (www) has dramatically transformed major aspects of those societies which have been 'connected.' The rapid spread of the www has driven major changes in the POTS and Internet networks, the multimedia features provided on most web sites are an example. The 'streaming voice' optimised POTS telephone system has had to adjust to support bursts of data transmissions while the data-burst oriented Internet system has had to adjust to support delivery of streaming multimedia. The terminology 'Internet telephony' reflects that convergence of the traditional voice with computer data networks. Although initially of interest as a means of completing a long distance call at the cost of a local call to an Internet service provider, Internet telephony is driving a broad convergence of the traditional POTS systems with Internet networks. Internet Telephony in a

Partially Connected World. Today's Internet telephony is only the beginning of a profound revolution. IP telephony will impact individuals, companies and corporations and the relations among the peoples of various nations.

Researchers, looking towards the future, try to better understand the evolution of the information technologies, systems, and applications that will result. Multimedia ranging from simple examples such as streaming video through 3-D applications will evolve quickly as the underlying power of computers and communication networks increases. Not far in the future, individuals will regularly interact at very high levels with a profoundly rich information environment, with social implications that are difficult to predict or imagine.

Unfortunately, there are substantial parts of the world still not connected to these information resources. A failure of underdeveloped nations to provide their people with universal connectivity to the information resources will accelerate growth of the gap between nations. In a region such as Central America, deployment of Internet telephony to the general population faces serious barriers.

### **Central America: Major Challenges**

Central America extends from the southern boundary of Mexico to the northern border of South. It includes, starting at the southern boundary of Mexico and moving southward, Guatemala, Belize, El Salvador, Honduras, Nicaragua, Costa Rica and Panama. Some recent data related to these countries is summarized in the table below. The data highlights several problems facing Central America overall, without touching on the political unrest and the large gap between the poor and the elite portions of the populations in several of these countries.

The low literacy rates of Guatemala, El Salvador, Honduras, and Nicaragua directly relate to the large portion of their populations living in extreme poverty. It also reflects the failure of the governments to improve adequately their educational infrastructure. For example, only 25 percent of the children attend secondary school in Guatemala. Over 50 percent of the Guatemala population survives on US\$1 per day, [approx.]. With such severe poverty, it is not realistic to expect school to be a priority for an impoverished Guatemalan child. This underlying problem, of a large, impoverished labour class and a small and wealthy ruling class, is seen in several other Central American countries.

The ability of government policies to dramatically impact the literacy rate was demonstrated in Nicaragua. In the early 1970s, the literacy rate was only 57 percent. A national literacy programme initiated in 1980, with increased educational spending, led to growth of the literacy rate to 87 percent by the mid-1980s.

However, subsequent events -civil war and accompanying economic problem - undermined this effort and the literacy rate fell back to 66 percent. The social divide between the wealthy upper class and the large, impoverished labour class has spawned several local civil wars in the region. This social conflict is a major barrier to advancing the access of new information technologies in the region. The civil unrest has prevented sustained economic efforts to advance the economic foundations of several Central American countries. As a result, these countries fall increasingly behind the developed nations.

The low penetration of telephone services in several Central American countries is evident in Table 1. The variations in penetration among the countries reflect, in part, the severe poverty that reduces the size of the potential market. Obviously, unless action is taken to improve the opportunities, to improve the lot of the population, the market will remain small and the penetration low. There is a substantial population of Native Americans and mixed Spanish/Native American people in Central America. They make up much of the underclass. This population, with its rich cultural heritage, could provide an important economic resource if helped to develop.

However, the social divide and the social resistance in several Central American countries imposes a serious barrier to such change.

### **Central America: Exploiting Information Technologies to Address Entrenched Problems**

The comments above depict several of the major challenges faced by Central America. The consequences will become more significant as advanced information systems - initially based on internet telephony and evolving to richer information communications environments in the near future - are deployed in developed countries.

However, if the cultural and political problems that have stalled the transition of Central America into strong economies can be set aside, information technologies might well provide an important foundation for building their economic futures. Central America is rich in natural beauty and rich in the cultures of its people. Both of these "natural resources" can be exploited in the global environment through the use of information-rich technological resources such as the Internet.

Throughout the world, the Internet and IP telephony have been remarkably successful in supporting small business initiatives. The Internet provides effective, efficient, access to global advertising, business technologies and to the world's markets and, in this way, builds and strengthens local economies. Some general initiatives seem natural and are briefly stated here:

- o The information environment pre-supposes individuals who have received significant education and who can enjoy their connection to the network. Educational initiatives for the young, including use of the Internet as part of the educational environment, will be a necessity. To provide students with the resources to explore the world beyond their view, and equip them to take advantage of that knowledge schools will have to be upgraded and furnished with computers connected to the Internet.
- o Given the rich cultural heritage of the Native American and Mestizo populations, opportunities exist to use their cultural products in the creation of small companies. Rather than working as middlemen in the manufacture of cloth for corporations outside, this cultural heritage could support an indigenous industry, similar to such activities elsewhere.
- o To provide much of Central America, including its rural areas, access to the Internet a 'jump-start' will be needed. Internet telephony centres, or some other forms of community information access centres, will be needed throughout the region. Deploying these centres should be a priority and may require government subsidies.

The above steps are obvious if internet telephony is to be implanted within a region where severe poverty dominates and opportunities for most of the people are very limited.

### **Conclusion**

In developed nations around the world, information technologies have been advancing at an astonishing rate. New gadgets and technical toys are continually coming to the market. Remember where we were just over 2,000 days ago, before the www arrived on the scene. Developing nations do not need the next and greatest information appliance or gadget with colour PDA screens supplemented with wireless networks to acquire e-mail while 'on the run.' Internet access alone is a powerful agent for change.

We propose that underdeveloped nations deploy only those Internet appliances and technologies consistent with the limited resources and the deployment barriers of underdeveloped nations.