the Availability Digest

www.availabilitydigest.com

Haiti's Cellular Network Failure Cost Lives

March 2010

The cost of system downtime can be measured in dollars, customer dissatisfaction, customer loss, regulatory actions, or bad press. At the extreme, the failure of a safety-critical system can result in loss of life. Sad to say, the Haitian cell-phone system proved to be a safety-critical system; and it failed.

Most Haitians have cell phones. They are inexpensive, and there is not much in the way of land lines in Haiti. Following the devastating 7.0 earthquake that struck in the afternoon of Tuesday, January 12th, many Haitians found themselves trapped in the rubble of fallen buildings. Some were able to call on their cell phones, report their position, and were saved. How many tried but could not get cell-phone service and perished, we will never know.

This is the story of one of the worst technological disasters in modern times.

The Haitian Cell-Phone System

Many developing countries are skipping or minimizing a wired infrastructure in which telephone service is provided by land lines. It has become much easier and simpler to set up a mobile network by erecting towers rather than stringing cable. In addition, mobile networks are more resilient and adaptable to change.

Haiti is no different.[1] Until the late 1990s, Haitian communications were land-line services provided by Teleco, a telephone company that is 98% owned by the government. Teleco has a monopoly on land-line service. In the 1970s, Teleco was a revenue generator for the government. Then the government started spending the profits on political campaigns and outright graft. Today, Teleco has only about 100,000 lines, only 30,000 of which are working.

Consequently, until 1999, Haiti had virtually no telephone service for its almost ten million people. This began to improve when Haiti's first privately-owned cellular company, Haitel, started offering cell-phone service. It was joined later that year by Comcel, giving Haitians a choice of two carriers.

However, Haiti is a very poor company. Few people could afford the $300 to $400 for a cell phone. This changed upon the formation of a new, very aggressive, cellular carrier, Digicel, in 2006. Digicel revolutionized the Haitian cell-phone market by selling cell phones for $20 and service for the equivalent of ten cents a minute. Even better, there were no contracts. Haitians bought minutes at kiosks or online. If they ran out of minutes, they could not make calls until they purchased more; but they could still receive calls.

[1] Telecommunications in Haiti, *Wikipedia.*

Haitel and Comcel quickly followed suit, and the Haitian cell-phone market exploded. Within one year, cell-phone coverage grew from 6% of the population to 30% of the population - a 5:1 increase – and has been growing rapidly since. Haiti is now the driving force behind cell-phone service in the Caribbean.

Today, Haitel has 200,000 subscribers on its 3G network; Comcel has 1,000,000 subscribers on its GSM network; and Digicel, by far the largest carrier, has 2,000,000 subscribers on its GSM network. Digicel and Comcel cellular services cover most of Haiti.

Haitians live by their cell phones.

Then the Earthquake

Broad cell-phone coverage ended for the Haitian people on January 12, 2010, when a massive 7.0 earthquake hit Haiti. Following the earthquake, only the Haitel network survived. What happened to Digicel and Comcel?

In Haiti, there are no local anti-blight laws. To save costs, Digicel and Comcel built their networks by placing small cell-phone towers on tops of buildings.[2] These buildings collapsed during the earthquake and the following aftershocks. The result was the widespread loss of cell-phone service in Port-au-Prince, the capital of Haiti, which was the most severely impacted in terms of property and loss of life. Digicel and Comcel services were similarly lost in many other cities and towns that were severely damaged, but service continued in rural areas where the carriers had used towers instead of buildings for their antennae. In total, almost 3,000,000 Haitians were suddenly without cell-phone service.

Haitel, on the other hand, had implemented its network using towers built to withstand earthquakes and hurricanes. Its network survived the earthquake; but being the smallest network in the country, it became quickly overloaded. However, Haitel subsequently had its own problems. It could not supply fuel to its emergency generators because of damaged storage tanks and impassible roads. A week and a half after the earthquake, its network was down. By this time, Digicel and Comcel had managed to restore some service. Though Haitel subscribers could not make calls, they could receive calls from Digicel and Comcel. It took Haitel another two weeks to restore service.

Network service was not the only problem facing Haitian cell-phone users. Many depended upon kiosks provided by the carriers to refresh their minutes. Most kiosks were destroyed in the cities, and people could not purchase additional minutes unless they had an account with their carrier. Then cell-phone batteries started to drain, and there was no power to recharge them.

Even the Haitian government was affected. They do not have their own network. They depend upon the commercial services of the cellular carriers. Therefore, they had no means to coordinate emergency services following the earthquake.

Help Me. I'm Trapped!

The importance of the cell-phone service that remained was exemplified by the many lives that it saved. People trapped in the rubble were able to call family and give their whereabouts. Families organized rescue teams to attempt to free their loved ones.

[2] Most of the material for this article was taken from an interview with Haitel engineer Charles-Edouard Denis, published in the IEEE Spectrum:
Anne-Marie Corley, Why Haiti's Cellphone Networks Failed, *IEEE Spectrum*; February, 2010.
Thanks to our subscriber, Paul Holenstein, for pointing us to this material.

But how many people died because they could not communicate? With an estimated 200,000+ people killed by the earthquake, it is likely that these poor souls measured in the thousands. In hindsight, the Haitian cell-phone network was an important safety-critical network. Unfortunately, it had not been designed as such.

What About International Service?

The need for local communication was the most critical. However, families from around the world were frantically trying to call their loved ones in Haiti; and Haitians were trying to call their families in other countries to tell them that they had survived.

There is only one undersea cable connecting Haiti with the outside world, and it is not yet in full commercial service because of high costs. It is government-owned and operated and was a gift to Teleco from the Bahamian phone company.

Consequently, most international service is via microwave links to the Dominican Republic, which shares the island of Hispaniola with Haiti. In the Dominican Republic, Haitian traffic received is routed internationally via undersea cables, which are in full operation. Microwave links are much less costly than laying copper or fiber cable across the 9,000 foot-high mountains separating the two countries. Besides, microwave links are not subject to vandalizing of the copper in the cable.

However, the earthquake initially knocked out the microwave links. Microwave links are line of sight, and the earthquake caused the microwave antennas to misalign. This was quickly corrected, and international traffic was restored shortly thereafter.

The world responded with cell-phone and satellite donations to Haiti. The cell phones were not initially very useful, but the satellite phones proved invaluable.

In addition, help came from the two Haitian Internet ISPs, Access Haiti and Hainet. They link to the Dominican Republic via microwave and managed to substantially survive the earthquake. They both offered free VoIP voice service to the U.S., Canada, and Europe.

Lessons Learned

Clearly, the Haitian cellular network must be rebuilt. This can be an opportunity to strengthen it. It must be recognized that in a country like Haiti, reliable communications can mean the difference between life and death for thousands of people following a disaster such as an earthquake or a hurricane. The new system must not only be reliable but recoverable.

Lesson number one is that the Haitian building codes may not reflect the stresses that disasters such as earthquakes and hurricanes can put on buildings (such as the earthquake codes in California and Chile that have also experienced disastrous earthquakes). Don't put cell-phone towers on buildings. Use earthquake- and hurricane-resistant cell-phone towers such as those used by Haitel.

Haiti's international service remained relatively intact because the microwave links to the Dominican Republic survived. What if these had been destroyed? The ultimate in disaster backup for communication links is satellite communications. Provisions should be made by the cellular carriers to have backup satellite terminals and reserved satellite channels to which to switch should their microwave links fail. And what about getting that one undersea cable into service?

Don't forget amateur radio. Hams can reach around the world today. Perhaps they ought to be organized to create an international network in an emergency.

Another interesting thought proposed by a blogger[3] addresses the problem of cellular network overload in any emergency such as this. He submits that three seconds of voice is equivalent to sending a full novel as text. Why not restrict subscribers (all but designated emergency services) to text-only following a major disaster?

And finally, there are the businesses. How many were prepared with their own disaster-recovery plans for a disaster such as this? How many will be substantially impacted or even go out of business because of this communication failure or because of other impacts of the earthquake?

All this leads to the importance of business-continuity planning (BCP). In this case, the need for BCP cut across the communication carriers, the government, and businesses. It seems that BC plans were lacking or were sorely inadequate.

[3] compro01, comment on Disaster Recovery For Haiti's Cell-Phone Networks, *Slashdot*; January 14, 2010.