the Availability Digest

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Help! My Data Center is Down!

Part 3: Internet Outages

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Long gone are the days of the isolated data center. Back then, batch jobs were submitted to update databases and to generate reports. Back then, turn-around times were measured in hours or even days. In today's competitive environment, IT services are online; and instant response times are expected.

What good is a data center if no one can talk to it? Orders can't be placed or tracked. Medical records can't be accessed. Online banking comes to a halt. Today's data centers must be connected. They depend upon the networks that allow users to access them online reliably and with fast response times.

In the old days, a company had control over its communication network. It leased lines that it used exclusively for its purposes. If it lost communications, it had direct access to its communication carrier for rapid repair. For critical applications, companies installed redundant communication facilities so that they could continue in operation even in the presence of a communications failure on one of their lines.

Not so true today. More and more, companies are relying on the public Internet to connect their users with company data centers. But how reliable is the Internet?

In our previous articles in this series, we related horror stories of unimaginable power failures and storage failures that took down the best-designed data centers. In this article, we explore some notable Internet failures that rendered data centers useless even though they were otherwise fully operational. These stories are taken from the Never Again archives of the *Availability Digest*.[1]

The Internet

The Internet is cheap. Today's browsers make it easy for users to connect to data centers. The Internet is flexible. If a new system comes online, no problem; just update the DNS server - there is no need to negotiate new leased lines with your carrier. The Internet is a self-repairing fabric. If a fault occurs at a node, traffic is simply rerouted around that node. But as a self-repairing fabric, does the Internet ever go down? You bet.

Vandals Take Out Much of Silicon Valley

Thousands of businesses and individual users in Silicon Valley and the San Francisco area were without Internet, phone, and wireless services for more than twelve hours on April 9, 2009, when vandals cut communication cables used by AT&T, Verizon, and Sprint. Cables were cut in two locations within a two-hour period. It turned out to be an easy operation. All the vandals had to do was to lift a manhole cover,

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climb down a ladder, and cut the cables. Though the perpetrators have yet to be caught, it is suspected that they may have been disgruntled employees since they seemed to have direct knowledge of which cables to cut.

Southeastern Nevada Telecommunications Service Interrupted for Two Days

All of Southeastern Nevada lost Embarq services and some Verizon services, including all Internet access, on the morning of December 10, 2008. A construction crew digging trenches for a new sewer system in downtown Las Vegas severed a conduit carrying several copper and fiber cables used by Embarq. It took two days to restore service. Verizon leases some of these channels from Embarq, and their services were consequently affected. This supports our rule that you should be sure that your redundant communication links do not use some common third-party carrier, or else your redundancy may be rendered meaningless by a fault in the third-party's network.

Hawaiians Go Without the Internet for Almost an Hour

Over 400,000 Hawaiians get their Internet, telephone, and television service from Oceanic Time Warner Cable. On May 2, 2009, a power outage caused by a generator defect took down Oceanic's cable and broadband services, affecting over 200,000 subscribers. Backup batteries powered the system for a few minutes, but the backup diesel generator failed to start. Though service was restored in less than an hour, the outage reflects the fragility of the Internet for critical corporate communications.

Comcast Outage Kills Internet for Maryland and Delaware

A concrete mixing truck accidentally hit a power pole on July 3, 2009, cutting Comcast's fiber line. The accident took out Internet, telephone, and video services for a large area of the lower Maryland-Delaware area for several hours. Even after the damage was repaired and after service was restored, multiple temporary outages continued for another several hours. During the outages, merchants could not accept credit cards; and the local newspaper, the Ocean City Today, could not get the emails necessary for its weekly issue.

Could the London Olympics Be Next?

London is set to host the Summer Olympics in 2012. BT (British Telecom) is the official communication services provider for the Games, and it is determined to have a flawless operation during the Olympics. Good luck. On Saturday afternoon, April 6, 2009, contractors working on the Olympic site sent a large-thrust borer right through a deep BT tunnel, severing multiple fiber cables and shutting down Internet and other communication services for tens of thousands of customers. The cable tunnel was 32 meters (about 100 feet) below street level. The tunnel was completely blocked and unsafe, and its depth made it very difficult to repair the cables. They had to be pulled to the surface, repaired, and then routed through a new conduit. BT was able to restore service to about 70% of the downed customers in two days, but 30% of the affected customers were still without Internet access for several more days.

Undersea Cable Fault Takes Out Internet throughout West Africa

There is only one fiber-optic cable linking West Africa to the rest of the world; and on July 30, 2009, the landing cable linking Nigeria failed. 70% of Nigerian Internet services went down, and other neighboring countries lost 100%. Though Nigeria had built a redundant land network, there was no backup for the landing cable. The only way to reroute traffic was over limited, expensive satellite channels. Banking services, phone services, and Internet services were all impacted. It took days to repair the cable and to return service to these countries.

Typhoon Disrupts East Asian Internet and Voice Services

From August 9 to August 12, 2009, users in Taiwan, Singapore, Hong Kong, and the Philippines watched their Internet services deteriorate from slow to none. It turns out that Typhoon Morakot damaged several undersea cables, not directly, but through undersea landslides. The landslides occurred over a several-day period, breaking cables one at a time. Though it took months to repair the cables, service was restored within a week by rerouting traffic over other networks.

Bandit Game Servers Take Down Much of China's Internet Services

China is rife with private servers used to illicitly run copies of popular games for profit. The operators of these servers have a history of launching distributed denial-of-service (DDOS) attacks on each other. However, in one case in May of 2009, an operator went too far. He launched a DDOS on a DNS (Domain Name Service) Server that provided URL-to-IP address conversions for several competitors. Unfortunately, this was a major DNS server in China's network. As it became overloaded, it sent excess DNS requests to other servers, which overloaded. Much of China's Internet service was down for hours.

Wild Street Saw Disrupts New York Trading

Just before the end of the trading day on September 15, 2009, when hedge funds depend upon millisecond trade execution times, a construction saw in one stroke severed 144 strands of fiber carrying 60,000,000 connections in New York City. The fiber cables fed just one building, a critical hub for global Internet connectivity in the Wall Street area. Though the fiber network throughout New York City is highly redundant with many alternate paths, one engineer said that 99% of New York buildings have single points of entry for all of their communication facilities.

Even the Amazon Gorilla Goes Down

A "networking event" on April 21, 2011, brought down portions of Amazon's cloud computing infrastructure along the U.S. East Coast. The problem triggered a large amount of remirroring of EBS (Elastic Block Storage) volumes in Amazon's northern Virginia data center, which handles Amazon Web Services in its East Coast Availability Zone. The remirroring activity caused a shortage of capacity in the Availability Zone, which impacted EBS volume recovery and new EBS volume creation. The outage, which began about 4 AM EST, took down AWS web sites and applications for more than a day.

Sydney Experiences Internet Outage When Contractor Drills Through Cables

The very next day after the Wall Street disaster related above, and halfway around the world, Internet users in Sydney, Australia, shared the pain of their Wall Street brethren. A contractor drilling test holes for a power-cable upgrade in Sydney's city center severed cables belonging to Australia's largest telecommunications provider, Telstra. The incident damaged eleven cables containing 10,000 communication lines. It required a week for Telstra to return full service to all of its subscribers in the area.

South Africa Isolated for a Day by a Cable Fault

The SAT-3 undersea cable that carries most of the traffic between South Africa and Europe broke down for about 24 hours on January 21, 2010, effectively isolating South Africa from Europe and the rest of the world. The incident started when Telkom, the cable operator, began maintenance on the cable after informing customers that they might experience increased latency on the channel for four to six hours. However, an error by maintenance personnel working on the power units caused a massive failure of the cable.

Iowa Internet Routing Error Affects 22 States

Customers of Mediacom, a major ISP serving 22 states in the middle U.S., started having problems with Internet connectivity Tuesday evening, January 22, 2010. At first, only customers in Columbia, Iowa, were impacted. But by the next evening and throughout the following morning, the problem had spread to customers in 22 states. The problem was finally traced to a routing error at Mediacom's Internet Network Operating Center in Iowa. Mediacom has installed additional monitoring facilities to address similar problems more efficiently in the future.

Minnesota's North Shore Cut Off From World by a Steam Pipe

During the midmorning of Tuesday, January 26, 2010, all counties in Minnesota's North Shore along Lake Superior were cut off from the rest of the world for about twelve hours by a fiber cable break. The North Shore is connected to Duluth, MN, via a single cable – no redundancy. Conjecture is that the cable was laid alongside a steam pipe, and the heat destroyed the cable. Affected were 911 services (which are routed to Duluth), senior FirstCall emergency alert buttons, customs agents at the Canadian border, ATM and credit/debit card transactions, banks, and online businesses.

Das Internet ist Kaput!

Over thirteen million German web sites use the country's top-level domain, .de. Millions of these web sites became inaccessible for almost two hours on May 13, 2010, when DENIC, the German Internet authority, uploaded new zone files that were empty. In effect, this meant that all web sites in those zones no longer existed. The web sites could not be reached, and email was rejected. Some reports indicated that all web sites beginning with "a" through "o" were down.

Skype Holiday Present – Down for a Day

Just as businesses were winding down for the holidays and as families were busy making plans to get together, the popular Skype Voice over IP (VoIP) telephone service went quiet. From the morning of Wednesday, December 22, 2010, customers were unable to place calls for over a day. Skype's network is a distributed peer-to-peer network in which hundreds of thousands of supernodes provide directory service and routing. Skype installs its VoIP supernode servers on any customer PC that is not behind a firewall. A bug in its supernode server caused certain nodes to crash, overloading other nodes. The problem cascaded to other super nodes, eventually taking down the Skype network.

The Mediterranean Achilles Heel

Much of Northern Africa's Internet traffic is linked to Europe as a gateway to the rest of the world via three submarine cables that lie in the Mediterranean Sea. Internet traffic for India, Pakistan, and the Middle Eastern countries are also routed to Europe over these cables. The cables link Alexandria, Egypt, with Palermo, Italy, where the traffic then moves on to Europe, the UK, and the Eastern United States. On January 30, 2008, two of these three cables were severed by the anchor of a huge freighter. All traffic was rerouted to the third surviving cable. However, the third cable became seriously overloaded, making the Internet almost useless and voice traffic barely intelligible. It took several weeks to repair the cables and to return service to normal. The cable carrying the bulk of the traffice was once again severed in April of 2010.

Queensland Telephone Service Severed by Cable Cut

A fiber-optic cable was cut by workers laying a pipe for Australia's Queensland water grid on July 15, 2008, collapsing the Optus communication network for over four hours. Communications throughout Queensland were abruptly terminated for more than a million customers when rerouting failed. Airports, hospitals, 000 emergency calls, government services, stockbrokers, and Internet access were all

affected. Unfortunately, a hardware fault had taken down the state's backup link the night before; so services weren't restored until the fiber could be repaired.

And Then There Was the Old Lady in Georgia

The country of Georgia, that is. A 75-year old lady was digging for copper cable on April 8, 2011, to sell on the black market when she came across a likely looking candidate. She dug up a long length of it, only to be disappointed when she found that it wasn't copper after all but optical fiber. It happened to be the backbone that connected much of the southern Caucasus to Europe. The damage cut off Internet access to most of Azerbaijan and Georgia for a half day. Mrs. Aishtan Shakarian was arrested, but she may serve only a light sentence because of her age.

Summary

A data center is useless if it is not accessible. Data centers use the Internet to provide connectivity between their external users and their data center servers. If the Internet should be lost, so are the services provided by the data center.

As the above stories illustrate, the Internet is not a guaranteed service – it is a best-efforts service. It can and does fail, often for days over wide geographic areas. Every company should have as part of its Business Continuity Plan a strategy for continuing operations should Internet access be lost.

Internet technology is also used to interconnect servers and users within the data center. These networks are called Intranets. In our next article in this series, we look at several Intranet failures that interrupted major functions within enterprises.