

Ensuring Consistent Performance During Infrastructure Outages: The Akamai Advantage During and After Taiwanese Earthquake

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Executive Summary

While the performance advantages of the Akamai platform are widely known, a growing number of enterprises use Akamai services first and foremost to ensure unprecedented Web site reliability in the face of both planned and unplanned events. The best recent example of the latter benefit is seen in the Taiwanese earthquake that severed several undersea telecommunications cables—cables that have since proven difficult to repair. The situation has led to sustained periods of Internet unavailability for businesses with locations in Taiwan, China, Hong Kong, Japan and Singapore. Performance degradations of 30% or more will last into March and beyond as the temporary failover routes are circuitous and typically sent over low-bandwidth satellite connections.

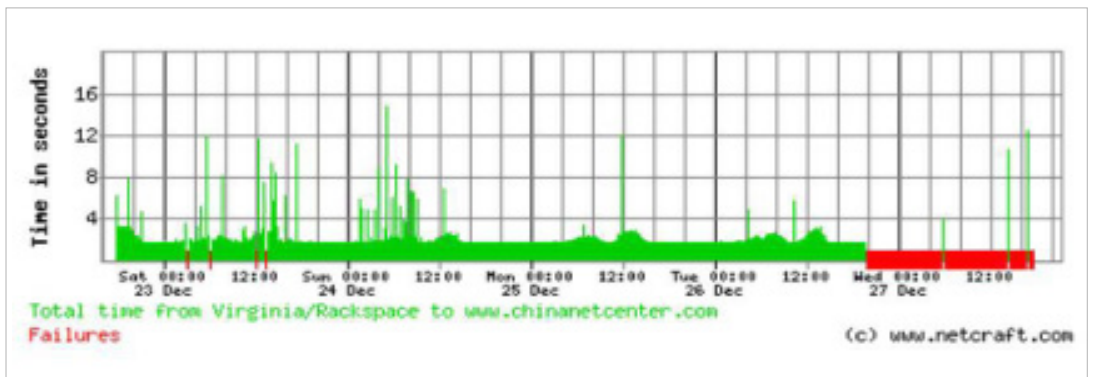
In contrast to users on traditional Internet infrastructure, Akamai customers enjoyed superior performance to and from sites in the Asia-Pacific region both during and after this unfortunate event. This is chiefly due to Akamai's globally distributed infrastructure and the dynamic mapping and optimized routing capabilities that detect and adjust to changes in Internet performance and availability. Akamai's advantage is also borne out by testing conducted using third party measurement services from Keynote Systems, as well as Akamai's own Site Analyzer performance analytics service. This document provides further detail on the earthquake and captures actual performance and availability data for Akamai customers.

Summary of Earthquake Impact

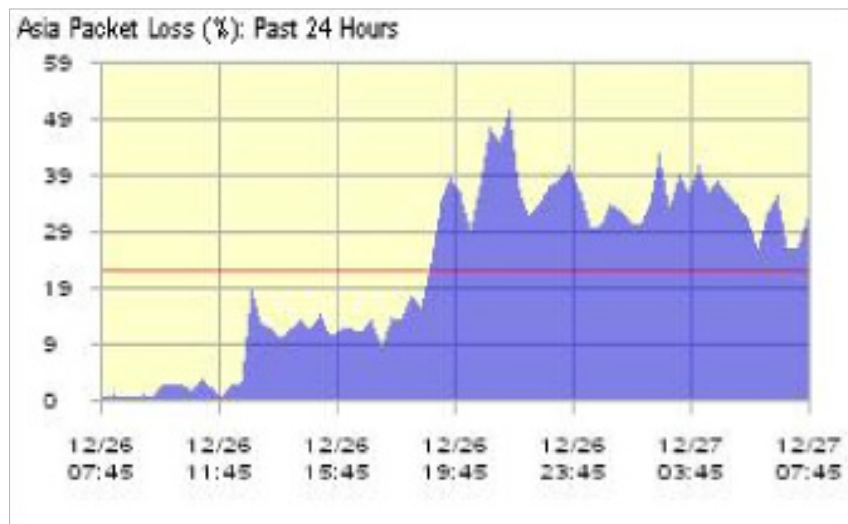
On December 26, 2006 an earthquake registering 7.1 on the Richter scale struck off the coast of Taiwan. The initial quake and aftershocks severed eight undersea communications cables, leaving many businesses in the Asia Pacific region with significantly reduced or absolutely no Internet connectivity. As a result, several currency and investment exchanges incurred significant losses exceeding millions of dollars daily. This doesn't include the uncalculated costs to other businesses due to loss in productivity while Web applications were unavailable or performing poorly.

To set context, these cables carried 90 percent of voice and data traffic in East and Southeast Asia. Specifically, the severed cables included the heavily used Sea-Me-We3 and APCN2 cables, according to Taiwan's Chunghwa Telecom. APCN2 is a ring that connects China, Hong Kong, Japan, the Republic of Korea, Malaysia, the Philippines, Singapore, and Taiwan. It is linked to Europe and the US by other ultra high-speed connections. As a result of the earthquake, Asian financial markets have struggled with telecom and Internet access to support trading activities.

An example of the earthquake's effect is seen with Chinese hosting provider China NetCenter who lost all connectivity just after initial tremors as indicated in the following graph from Netcraft:



Following the earthquake, packet loss in the region exceeded 50% as evidenced in the following graph from the Internet Traffic Report:



One leading cause of packet loss can be found in the rerouting of traffic. Taiwan's Chunghwa Telecom said in some cases Internet data sent from Taiwan to Hong Kong, only some 650 kilometers away, were going through routers in the United States. And Singapore Telecom said its U.S.-bound traffic was sent through an undersea cable west of Australia, across Australia from Perth to Sydney and through a southern link across the Pacific—or going west via Europe.

The Akamai Advantage

Akamai's 20,000 servers located within 70 countries globally enable Akamai customers to improve performance and reliability through several techniques. Akamai's Web Application Accelerator and Dynamic Site Accelerator services are purpose-built to deliver consistent, improved performance for dynamic transactions using a number of techniques, many of which are unique to Akamai. These include:

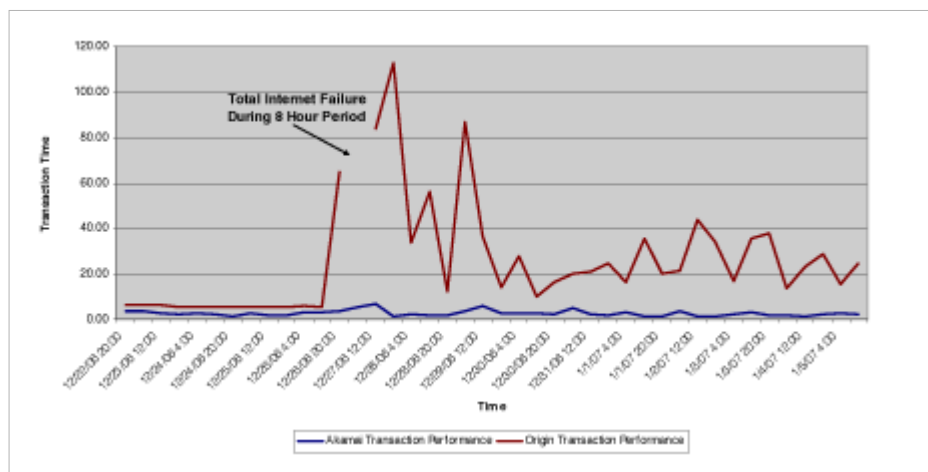
- Dynamically Mapping User Requests to an Optimal Akamai Edge Server**
 This allows Akamai to respond in real time to changing Internet conditions, alleviating the impact of network problems and improving availability of customer applications. This is in contrast to "static mapping" which assigns a block of IPs to specific server locations independent of network conditions.
- Route Optimization Technology**
 This patented technology enables Akamai to avoid Internet problem spots, sending application transactions over Internet paths that are known to be fast and reliable.
- Connection Optimization Technology**
 Akamai services incorporate a number of capabilities, including compression, long-lived inter-server connections, content pre-fetching, and transport protocol optimization. Combined, they accelerate even the most dynamic and uncacheable content.

In China specially, where online business operations have been hardest hit by the effects of the earthquake, Akamai customers have experienced near 100 percent availability for Web transactions delivered via the Akamai platform versus an average of 40 percent availability for transactions delivered from a company's origin infrastructure. This is due in part to the fact that Akamai operates in close partnership with several regulated service providers in China to ensure compliance with all local requirements. Customers of Akamai continue to receive consistent high performance as content is delivered from locations within and around China.

During the week following the earthquake, tests have shown that Web transactions for online businesses not leveraging Akamai were either unavailable, or took as long as 1-2 minutes to complete. Conversely, Web transactions delivered by Akamai peaked to roughly 4-5 seconds following the earthquake, before returning to pre-quake levels of an average of 2 seconds. Packet loss data paints an even more dramatic picture; spiking to 65% where Akamai kept near linear zero percent loss, as illustrated in the graphs below. Note that the times when the earthquake was measured does not correspond to the spikes that Akamai saw on the transaction or loss graphs. Instead, over a period of 12 - 14 hours after the earthquake, several undersea cables went down. The earthquake happened at 12:25 GMT on Dec 26th.

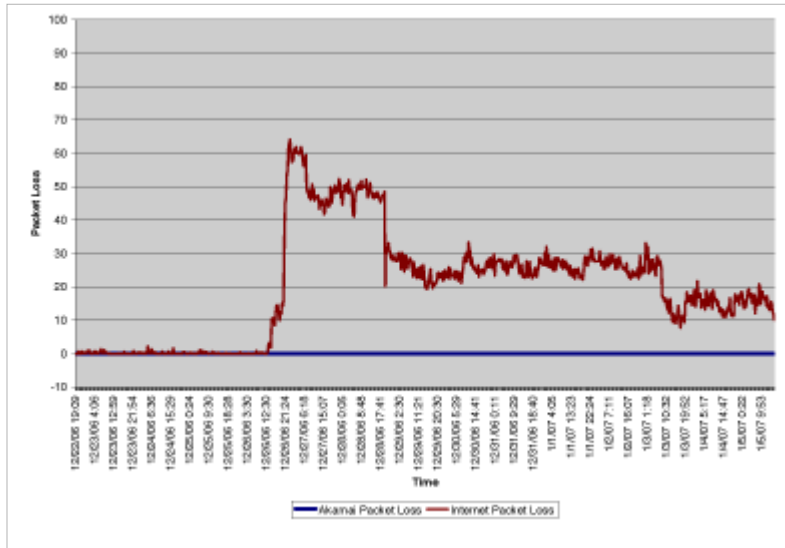
Web Transaction Data (Dec. 22nd – Jan. 5th)

The above graph shows the average time taken to run a simple Web transaction, equivalent to a user viewing a Web page. The tests were run from three locations in China: Beijing, Hong Kong, and Shanghai. The test Web server was located in Pennsylvania, in the United States. Users viewing the page without Akamai would have seen total failures or would have waited for close to two minutes. A week later, users still have an average 30-second delay. When delivered by Akamai, users would have noticed very little issue accessing content.



Packet Loss (Dec. 22nd – Jan. 5th)

The network loss graph shows loss data from locations in Asia to the U.S. The graph shows average loss from three locations in Asia (Beijing, Taipei, and Singapore) to six locations in the U.S (Chicago, Dallas, New York City, San Jose, Seattle, Washington DC). Using Akamai's SureRoute technology and global platform, Akamai was able to route data around areas of significant problems providing a consistent quality network connection resulting in very low packet loss. To understand how packet loss affects voice and data applications, see sidebar titled "What does packet loss mean?"



Earthquake's Effects Remain Through Q1

Heading into the fourth week following the initial earthquake, performance issues remain as repairs to the eight severed cables are delayed. Despite using alternative connections, Internet availability is still 30% below average levels, according to an article published in the Taipei Times. The Hong Kong Telecommunications Authority said this week (January 16, 2006) that repairs on all the damaged cables (which lay 2 miles below sea surface) would not be completed until the middle of February, weather conditions permitting and assuming that they can locate all of the cables. Delays are likely because the damage is more extensive than initially thought, with some cables severed in at least 10 places. In addition, the cables are submerged 2 miles and are located using a 19th century system of dragging hooks along the ocean floor. During this extended repair time, enterprises are finding that the satellite links that are employed as backups are significantly more expensive for enterprises, and at the same time, significantly slower. As a result, across the Asia Pacific and in China, Hong Kong and Taiwan in particular, users are finding that out-of-region Web sites and applications perform much slower than was typically the case. Similarly, Web based applications (Supply Chain Management, Customer Resource Management, etc) that run between US-based headquarters locations and APAC manufacturing facilities are significantly hampered as well.

This contradicts conventional wisdom that the Internet can heal itself. "We're heading towards the fourth week after the earthquake and not a single cable has been repaired," said Todd Underwood, an analyst at Internet and communications traffic monitoring firm Renesys in an InformationWeek interview conducted Wednesday January 17. "It's a tough situation with deep water, rough seas, and not many boats available."

Even once the situation is remedied, it underscores the limitations of Internet infrastructure as these economies grow. "There's a longer term story to this," Underwood adds. "This could turn into an industry liability in the second half of the year." He explained that some Asian countries in general, and China in particular, are finding that robust communications connections are a necessity as they modernize their economies with the latest Web and IP-based applications. To that point, this isn't the first time that the Asia Pacific region has encountered these issues. In the past, shipping activities were the main cause of impaired undersea cables. Last December 2005, the Asia Pacific Cable Network was damaged by shipping activities. In September 2006, a similar fault on the China-US and SEA-ME-WE3 cables also affected Web access.

Summary

As enterprises move business processes online for cost and time efficiencies, the risks of downtime are critical to companies' success. Downtime can be caused by planned and unplanned maintenance, physical disasters, distributed denial of service (DDoS) attacks, viruses, and unpredictable flash crowds. The availability of an enterprise's Web operations is vital to building and maintaining its brand equity and customer loyalty, ensuring communications with customers and partners, and ultimately generating revenue. The inherent nature of Akamai's massively distributed global network provides a shock absorbing effect to protect a company's centralized infrastructure and preserve high availability. Performance and availability testing during and after this event prove Akamai's value not just against standard infrastructure but also against competing solutions with less mature technology and deployments.

Addendum: What does packet loss mean?

- 1) [The standard VoIP encoding] "requires packet loss far less than 1 percent to avoid audible errors. Ideally, there should be no packet loss for VoIP"
Source: Quality of Service for Voice over IP, Cisco,
http://www.cisco.com/en/US/tech/tk652/tk698/technologies_white_paper09186a00800d6b73.shtml
- 2) At 3% packet loss, downloading a Web page may appear to be 30%-100% slower for some users.
Source: Client Perceived Response Time and Its Relationship to Different Link and Page Characteristics, IBM Corporation,
<http://www.research.ibm.com/people/a/agrawal/talks/URTEperiments.pdf>
- 3) Above 10-12% packet loss connections start to get broken, and video conferencing is unusable.
Source: Tutorial on Internet Monitoring & PingER at SLAC
<http://www.slac.stanford.edu/comp/net/wan-mon/tutorial.html>
- 4) Above 12% packet loss, interactive work becomes unusable
Source: Network Connectivity, R. Les Cottrell, Stanford Linear Accelerator Center (SLAC)
<http://www-project.slac.stanford.edu/streaming-media/SLUO/pdf/sluo8.pdf>

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AKAMWP-EQ-BEST-0107



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