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WHITE PAPER

# The Value of a Content Delivery Network



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## Introduction

Content Delivery Networks (CDNs) provide the necessary infrastructure for companies to efficiently deliver digital content to users around the world. Most commonly, digital media such as video, audio, software downloads, applications, mission-critical content, images, and games are delivered via CDNs.

NTT America has industry leading technologies to globally deliver our clients' content faster and more cost-effectively. Our content delivery methods take full advantage of industry leading technology, enabling us to provide optimal performance for clients at a very low total cost of ownership (TCO).

The purpose of this white paper is to explain the components that comprise the NTT America CDN, and outline the technology and benefits of each component. As detailed in the following sections, the combination of our strategic global footprint, routing and location algorithms, caching and storage solutions, and advanced software tools set us apart from the competition.

## Performance

A number of key drivers are requiring companies to utilize a CDN. As more and more content - especially large files such as media content - becomes available online, and as more users around the world get broadband connections, the need to make content more accessible and place it as close to the end user as possible has become apparent.

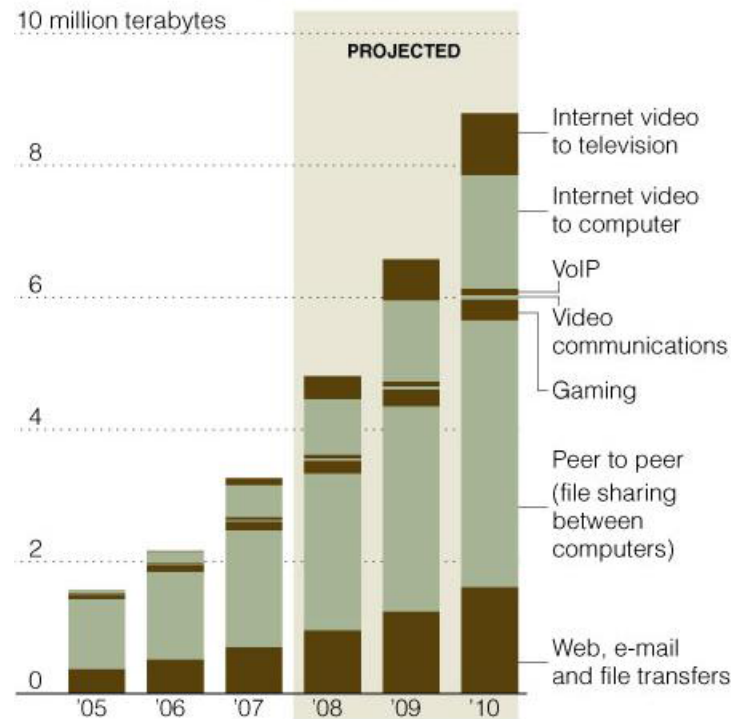
Traditional web hosting companies can effectively deliver non-mission critical content, i.e. content that can be delivered to users without an emphasis on the speed of delivery. Content may load very quickly for some end users who are located near the server hosting the content. However, for much of the world, the performance of the content will suffer for reasons probably outside the control of the web hosting company. Network congestion, many network paths to reach the content, poor performance of the end user's connection, or unsatisfactory server performance of the web host can all lead to a degradation of the content.

The exponential growth of digital content, including video and large files, coupled with the explosive increase in global broadband adoption, drive these performances to increase tenfold. Armed with faster Internet connections, users expect video that loads instantly and plays flawlessly, their purchased content to download at warp speed, and game and software delivery that does not suffer from network latency or other problems. A recent New York Times article discussed this trend, and concluded that the increasing amount of data will cause internet traffic to quadruple by 2011, overwhelming available capacity.



## Busier and Busier

### GLOBAL CONSUMER INTERNET TRAFFIC



Source: Cisco Systems

THE NEW YORK TIMES

Web hosting companies with one central server farm just do not have the resources, network, or technology to provide this type of service to their customer base.

A well-designed CDN avoids the bottlenecks and pitfalls of a traditional web host. To understand its inner workings, we must consider the following key facets of such a CDN:

### GLOBAL FOOTPRINT

Rather than host customer content in one location, CDNs place caching servers at many points of presence (POPs) around the world. Based on routing and DNS, most CDNs attempt to route an end user to the POP closest to them in order to retrieve the content. In this manner, a CDN brings content closer to the user and avoids sending the user halfway around the world over numerous networks to reach the content. This does remain an inexact science, and requires complex routing and technology to effectively manage the algorithms and decisions behind the routing methods.



## CACHING

At the POPs, content is cached, or temporarily stored for a period of time. Assuming the requested content is in a local cache at a POP, the content can be delivered directly from that POP to an end user who is geographically close to that location, thus allowing for optimal speed and performance. Because of limitations of their architecture (such as very low local storage capacities), legacy CDNs have experienced a number of challenges with caching. In today's world of videos and large files, it has become harder and harder to keep an effective percentage of content in cache, especially for CDNs with hundreds of POPs worldwide.

The economics of storing large files many times over do not make sense and result in a lower "cache hit ratio." In other words, users will frequently request a file from the local CDN POP, but the file will not be found. This "cache miss" requires the user to be routed back to the origin server, that is, the storage server which actually has the original copy of the file, in order to retrieve the content. Such a cache miss causes performance lags, which means a slower download or, in the case of video, a degraded viewing experience. Once the content is eventually delivered to the user, it will be cached at the local POP, where it will be served to subsequent local end users until it is once again "bumped" from the local cache and will again need to be retrieved from storage.

## STORAGE

CDNs maintain storage servers where content is stored to be retrieved and locally cached at the caching POPs. These storage servers are known as "origin" servers in CDN terminology. Sometimes, customers maintain the origin servers in their own network, and the CDN caching servers retrieve the content directly from the customer site. It may be more reliable for CDNs to store the content on their own origin servers, and some have multiple storage locations, which provide an extra layer of redundancy and fewer points of failure.

A CDN is certainly necessary for many content delivery applications that cannot be adequately served by traditional web hosting. Occasionally, companies attempt to build their own content delivery network, and have had varying levels of success. A handful of the largest online presences in the world have been able to build their own, but this is very much the exception rather than the norm.

Building a CDN is a daunting task and requires a global investment in data centers, hardware, bandwidth carriers, massive storage arrays, and countless routing and caching algorithms. On top of that, an extraordinary software build-out is required to provide the necessary reporting and content management tools. Thus, the vast majority of organizations - even very large ones - choose to outsource their CDN business and take advantage of the technologies available from NTT America and other CDN vendors.



## The Second Generation of CDNs

The increasing demand for rich media content distribution across the web has put a heavy burden on the first generation of CDNs to enter the marketplace. Large files such as video, images, games and audio are driving online media consumption and web usage to all-time highs. End users expect a TV-like experience when watching video online and a high fidelity experience when listening to music. That means instant starts with no buffering, quick channel changing, and very high quality images and sound. Media companies are turning to CDNs to deliver this performance, but the older first generation CDNs are having a hard time addressing their needs.

First generation CDNs built an infrastructure during the 1990s, which was optimized to support the distribution of smaller objects. The early demand for CDNs was focused around ensuring that popular websites were highly available and fast to load. Back then, slow dialup connections were the standard method by which most end users connected to the Internet. This meant that first generation CDNs had to set up an edge network of many thousands of smaller storage servers on the edge of the Internet, in high Internet usage locations. POPs had only a handful of these small servers on average, and they were able to store the most popular websites, with their images and some HTML files. They didn't need to have as much computing power because dialup didn't demand fast downloads. Effectively, the first generation of CDNs was set up to handle the distribution and storage of small files like logos, images, HTML, etc. over a slow Internet connection.

As we know, the world has changed. Due to the massive proliferation of broadband, end users have much faster connections, demanding faster downloads, and they use computers that are capable of handling much larger files. Combine this with the growth of video, photos, music and gaming downloads and the burden on first-generation CDN infrastructure has increased dramatically over this relatively short period, and will continue to surge in the future.

Second generation CDNs such as NTT America have entered the market to address this problem. Instead of having a small storage footprint in many locations, NTT America has massive storage availability in fewer locations. By strategically locating points of presence in large metropolitan areas and at the largest and most critical Internet peering points, we are able to connect our customers' content to the Internet at the points closest to their end users. The difference is that NTT America has terabytes of storage at each location, with incredibly powerful streaming, switching and processing technology all designed to push content out faster. This ensures a very high cache hit ratio, meaning that we make fewer calls to pull the original file from its origin storage server, as our edge storage doesn't fill up as quickly. When end users request a popular file over and over again, it will be there - on the edge - and instantly available. With legacy CDNs, there just isn't enough storage in each location to keep large files for any relevant length of time. This requires the cache server to constantly reload popular rich media content from the origin servers, resulting in considerably poorer performance and a degraded user experience.



## Conclusion

Although a number of different content delivery models exist, most of them were built to address the demands of an Internet that is long gone. The NTT America architecture provides an advanced content delivery solution built for the web of today, one full of high speed connections, rich media, and huge files.

But truly validating this approach can't be done in a corporate white paper—it's done in the real world, by customers and other unbiased third parties. That validation continues to build: NTT America has more than 1500 satisfied customers, and independent testing by Gomez and Keynote consistently ranks NTT America among the best performing CDNs in the world.

## About NTT America

Delivering any data, anywhere, any time, NTT America has the world's fastest and most reliable content delivery network. To learn more, visit [www.us.ntt.net](http://www.us.ntt.net)