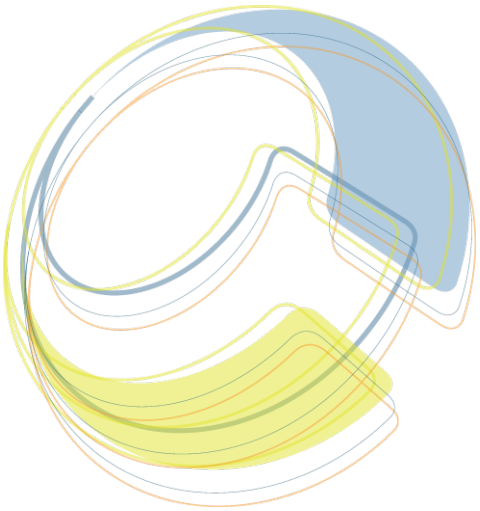
CDNetworks

WHITE PAPER

Dynamic Web Acceleration
What is it, who needs it, how it works



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Executive Summary

Dynamic web acceleration is a service offered by Content Delivery Networks (CDNs) that enables organizations to quickly and reliably deliver applications and dynamic content from a centralized infrastructure to users around the world. These capabilities are critical to nearly all Fortune 2000 businesses, as well as web-focused retailers and software-as-a-service providers. For they all share a common challenge: the need to deliver a high-quality experience to a user base that is increasingly dispersed around the globe.

Yet the standard Internet protocols were not designed to support the delivery of applications and dynamic content. For this reason, many organizations' website users suffer through periods of poor application performance or sluggish display of web content, resulting in declines in enterprise productivity, consumer dissatisfaction, and lower revenues. In fact, an August 2009 study by Forrester Research revealed that a majority of ecommerce sites need to load a page in less than two seconds in order to keep customers happy.[1] As page load times increase, so do the rates for shopping cart abandonment and customer churn.

The issue of slow page loads is not isolated to ecommerce sites. According to The Yankee Group, forty percent of enterprise employees work outside corporate headquarters.[2] Because these employees rely on access to a range of business applications and data delivered via the web, page load times can drastically affect the overall performance of an entire organization.

With today's advanced hardware and software for web acceleration, most websites can generate dynamic content in just a second or two at the origin server. Plus, the prevalence of broadband connections has reduced last-mile delays to a few tenths of a second for average sized web pages. Network-level backbone latencies can also be measured in tenths of a second or less, even for international transit. So why, then, does it commonly take three to ten seconds, or even more, to return a response to an end user?

This paper explains the reasons behind poor website application and dynamic content delivery performance. It also demonstrates how dynamic web acceleration solutions can help organizations overcome such poor performance.

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1 Forrester Consulting, eCommerce Web Site Performance Today: An Updated Look At Consumer Reaction To A Poor Online Shopping Experience, August 17, 2009

2 The Yankee Group, Anywhere Enterprise – Large: 2007 U.S. Mobile Blended Lifestyle Survey, May 31, 2007

The Problem: Inherent Internet Issues

Advanced technologies and broadband proliferation have dramatically raised the bar when it comes to what qualifies as an acceptable online user experience. Regardless of how engaging and well designed a website is, it will lose visitors if the experience isn't fast, compelling, and satisfying. Unfortunately, even the most optimized origin servers can't guarantee high and consistent levels of performance because they are susceptible to the delays and other performance problems caused by Internet latency and congestion. These issues are the most common cause of a poor end-user experience, leading to site abandonment, lost productivity and brand erosion.

A SAMPLING OF TODAY'S DYNAMIC MISSION-CRITICAL APPLICATIONS

- Business Intelligence
- Collaboration
- Compliance & Risk Management
- Customer Relationship Management
- Document Management
- eCommerce
- eLearning
- Electronic Design Automation
- Enterprise Resource Planning
- Help Desk
- Human Resource Management
- IT/Application Management
- Procurement
- Product Configurators
- Product Lifecycle Management
- Sales Force Automation
- Supply Chain Management
- Talent Management
- Transportation and Logistics
- Vendor Management

The Internet was not designed to support the fast delivery of the mission-critical applications found on so many websites. And technologies designed to improve Internet performance – including caching, content delivery, and intelligent routing – do not adequately address the performance requirements of dynamic, web-based applications. These problems are magnified for dynamic, non-cacheable content due to a greater dependency on the origin server and the distance between an end user and the origin server. Dynamic content is non-cacheable because it is highly personalized and time-sensitive. Minutes, or even moments, after dynamic content is cached, it becomes irrelevant. As a result, effectively serving dynamic content requires continuous connectivity between end users and the application server. Yet legacy TCP/IP, with its narrowband transmission protocol, was not developed to maintain this needed level of connectivity.

Recently, more attention has been given to the speed and performance of dynamic, web-based applications for two major reasons. First, today's extended enterprises typically have employees, customers, and partners accessing enterprise applications from all corners of the globe. Second, e-commerce continues its massive growth, with U.S. online retail sales alone forecasted to reach $250 billion by 2014, according to Forrester Research.[3] Against this backdrop, Forrester Research recently found that fifty-eight percent of website users stated that site performance is a key determinant in dictating whether or not they will return to a website.[4]

What Causes the Problem?

The standard measure of network latency is round-trip time (RTT) - the time it takes for an IP packet to travel from one location to another and for a response packet to travel back. Round-trip time encompasses many factors such as indirect routing, hop count, and the speed of light. However, backbone round-trip times are generally low. Round-trip times between two well-connected locations in the U.S. are well under one tenth of a second

3 TechCrunch, Forrester Forecast: Online Retail Sales Will Grow To $250 Billion By 2014, March 8, 2010

4 Forrester Research, Best Practices: Attaining And Maintaining Blazing Fast Web Site Performance, February 4, 2009

(100ms) on average and, unless there is serious Internet congestion, round-trip times between the U.S. and Europe or Asia are generally less than 200ms. So round-trip times on their own cannot fully explain low-response rates.

The real culprit for disparity between a low round-trip time and multi-second latency impact lies within the TCP and HTTP protocols. During the course of a typical full-page web download, TCP and HTTP together force numerous back-and-forth exchanges. Every new TCP connection requires a delay of one round-trip to simply establish a new connection (known as "the handshake") and then additional round-trips to finish the transfer. This activity results in a large number of 'turns' between client and server. In general, the number of turns (RTT multiplier) depends on many factors, including page size, composition, and the client and server technologies used. A secondary penalty occurs if IP packets get dropped. Due to the way TCP and HTTP interact, it's common to see a TCP "timeout" if a packet is lost during a web page download. This is usually a multi-second penalty on top of the latency created by RTT and the multiplier.

As a result, the middle-mile web performance problem is not just a function of round-trip times; rather, it is the combined effect of round-trip time and the number of 'turns'. It is not just packet loss; it is packet loss together with TCP timeout-based recovery. Typical web acceleration technologies view the middle-mile problem as a network layer issue. Replication and web caching reduce round-trip times by placing content closer to the end user, and advanced routing technologies reduce round-trip times and packet loss by choosing better backbone paths. But these technologies alone do not address transparent turn reduction or loss recovery.

The Solution: Dynamic Web Acceleration

Solutions called dynamic web acceleration, or Application Delivery Networks (ADN), promise to address these performance issues, leading to increased productivity, higher customer satisfaction, and a much better user experience. Dynamic web acceleration solutions can help enterprises deliver extremely fast response times and increased application availability while maintaining the cost benefits of a centralized datacenter and application infrastructure.

A dynamic web acceleration solution is a system of speeding up the delivery of applications that rely upon networks such as the Internet. By increasing the TCP throughput and maintaining a pool of open connections, dynamic web acceleration solutions significantly reduce the number of round-trips, thereby accelerating application response time. Dynamic web acceleration does not work by enabling the server to process information faster; rather, it speeds up and optimizes the way the server interacts with the network.

WAN optimization should not be confused with dynamic web acceleration since it focuses exclusively on limiting congestion effects of wide-area networks, improving server utilization through compression and traffic prioritization. While the key performance metric of WAN optimization is to increase the resource efficiency of the application backend and, to some extent, the network, the key performance metric of a dynamic web acceleration solution is to improve application responsiveness.

Who Can Benefit from Dynamic Web Acceleration

Any global company featuring dynamic, web-based applications as part of its brand experience (for example, 'build your own' car configurator on an auto website) or to deliver its entire service offering (SaaS providers) can benefit significantly from a dynamic web acceleration solution. This is especially true for companies that want to lower operating costs by consolidating datacenters while still ensuring the successful delivery and performance of their online applications. Managing multiple, globally distributed datacenters housing mission-critical application servers can be expensive and resource-intensive. Moreover, to adequately ensure optimal delivery of applications and content around the world, most organizations would need to build out an inordinate number of datacenters. Dynamic web acceleration solutions represent a small fraction of the costs a company would incur building out its own high-performance network to provide a rich, compelling end-user experience.

DO WE REALLY NEED DYNAMIC WEB ACCELERATION?

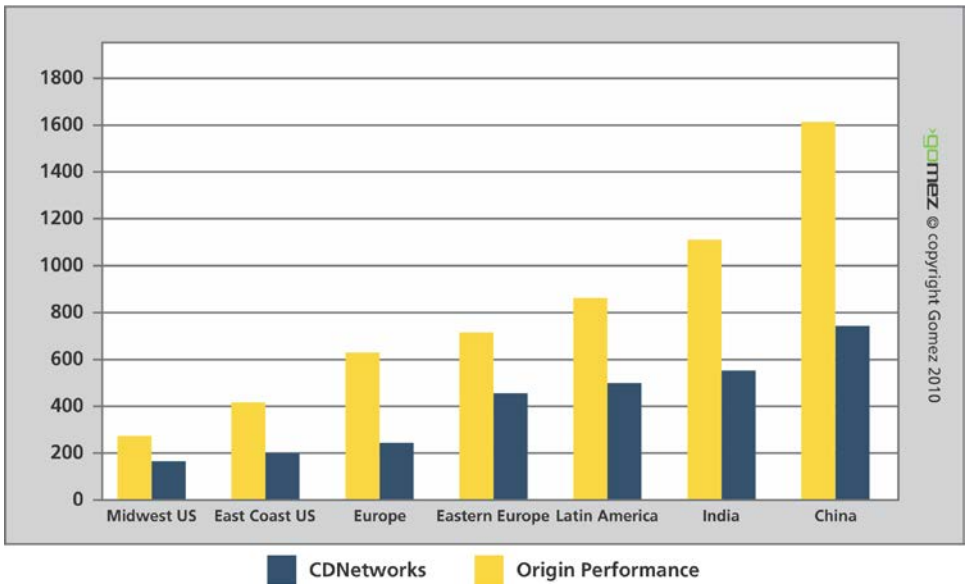
If end users of a web-based application are far away (more than 30ms delay each way) from an application data source that is consulted frequently during the course of a web session, dynamic web acceleration is highly recommended to significantly improve the end-user experience.

The CDNetworks Approach

The CDNetworks Dynamic Web Acceleration platform comprises a global network featuring two types of specialized server clusters: EDGES through which users access the network, and SHIELDS, through which a customer's applications are made available to end users. The CDNetworks global DNS redirection and IP address-mapping system transparently directs users to customer applications optimized by our Dynamic Web Acceleration services.

CDNetworks addresses HTTP/TCP inefficiencies in a different, more direct way than other dynamic web acceleration solutions. Other solutions focus on optimizing only the small portions of an application's objects that are cacheable. By contrast, CDNetworks caches that same content, and at the same time, optimizes the major portions of content that are dynamic and non-cacheable. The CDNetworks solution transparently reduces response time while increasing application availability. It does not distribute content or application code, but instead, utilizes a high-performance transport protocol across the middle mile. This high-performance architecture is designed to address high-latency networks and the request/response nature of web-based applications. The result is that distance-induced delay is greatly minimized.

The CDNetworks Dynamic Web Acceleration solution works best for highly dynamic and interactive web applications with little repeat traffic aimed at a global audience. CDNetworks' strategically deployed network provides outstanding performance and coverage in all areas of the world, and is especially effective at efficiently and dramatically improving the performance of web-based applications delivered in emerging broadband markets, including China, India, and South Africa. In addition, because our solution is an open platform, our customers are not locked into a proprietary platform. Our platform is simple to use and can be easily integrated with any web-based application without making changes to the application.



CDNetworks uses a high-performance transport protocol to transparently reduce response time and increase application availability.

Case Study: Streamlining the Retail Supply Chain with Dynamic Web Acceleration

Historic Futures (HF) is a recognized expert in supply-chain traceability with world leading technologies and consulting expertise. The company makes it possible for brands and retailers to visualize their entire supply chain, from primary production to finished product.

HF designed and developed an online application called String, a secure, online service that allows batch-level product information to be shared throughout the supply chain. Applications include Country of Origin (COO) management, collection of key performance indicators from extended supply-chains, and reporting of water and energy consumption. In this way, String enables organizations to visualize and manage compliance and certification status beyond their tier 1 supply base.

HF's website visitors were suffering through a poor user experience when accessing String from anywhere in the world, be it China, Europe, the USA, or anywhere else. In some instances, the String application was completely unusable due to poor performance. This was unacceptable to HF management, who recognized the strategic importance of String as a high value-add customer relationship tool for HF.

HF turned to CDNetworks and performed a beta test of its Dynamic Web Acceleration solution. Within weeks, the page load time for String was reduced by 80% across the globe, and upwards of 92% in the regions where performance had most suffered.

Today, the HF website – and String – enjoy high levels of user satisfaction. And HF's web technology team is happy to save money originally earmarked for expanding its web infrastructure. Instead, it can spend the funds to enhance the functionality of String.

Conclusion: A Simple Solution for Enhanced eCommerce, Greater Application Adoption, and Lower Costs

Global companies face opposing requirements when moving business-critical applications and processes to the Internet. First, they must minimize the cost and complexity of global datacenter deployments and secondly, they must ensure greater application adoption and use by assuring that functionality and performance meet user expectations. As network distances increase between the user and the application, response time slows, making applications unusable.

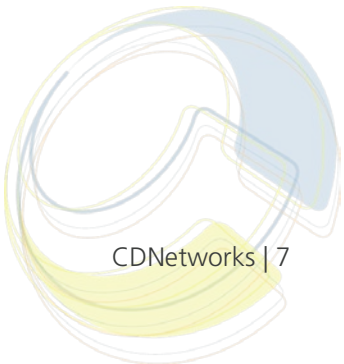
Delivering web applications over the Internet and ensuring reasonable response times for users around the globe is a significant challenge. In the past, companies have tried to address this problem by replicating datacenters closer to users around the globe, increasing cost, complexity, and risk of inconsistent data. Overcoming these challenges is essential to realizing the bottom-line business benefits promised by web-enablement.

CDNetworks' Dynamic Web Acceleration solution promises to address these issues, helping enterprises increase the speed and performance of web-based applications by as much as 10X, leading to increased productivity, lower operating costs, and a much better user experience.

Appendix: Key Features of CDNetworks' Dynamic Web Acceleration Solution

Feature	Description	Benefit
Application Layer Acceleration	Optimizations include caching, compression, load balancing, SSL offload, and the complete suite of HTTP(S) acceleration technologies.	Improves performance at application layer.
Connection Management	Proactive management of the connections between the CDNetworks Dynamic Web Acceleration solution and a customer's web application servers.	Ensures a more efficient use of server resources and greater end-user performance.
State-of-the-Art Protocol Stack	Standards-compliant transport protocol that uses the latest advances in TCP research and implementation.	Provides optimal performance over the long-haul segments of the Internet.
Network Loss Protection	Advanced loss and congestion recovery techniques that reduce the impact of packet loss and congestion problems.	Enables predictable application performance for end users.
Origin Connection Load Reduction	Aggregates connections through CDNetworks' Origin Connection POPs.	Decreases the load of customers' expensive application server database assets.
SSL Offload	Acts as an efficient front-end processor to manage SSL connections and requests.	Offloads customers' servers, freeing them to execute high-value application processing.
Transparent Turn Reduction	Reduces the unnecessary number of back-and-forth transfers between the end user and the web server.	Eliminates protocol overhead caused by the properties of TCP and HTTP.

To find out more about CDNetworks Dynamic Web Acceleration, visit http://www.us.cdnetworks.com/dynamic_web_acceleration



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About CDNetworks

CDNetworks enables mission critical e-business in the world's most challenging markets. CDNetworks' unique position as the only multinational CDN with expertise and infrastructure in China, and other emerging markets, makes us a trusted technology and business advisor to more than 1,200 companies across the highly-competitive industries of software, travel, eCommerce, high tech, manufacturing, media, and gaming. Reliably delivering over-the-top performance anywhere in the world, CDNetworks helps businesses get closer to their end users without the limitations of hardware and private networks. Founded in 2000, CDNetworks has offices in the U.S., Korea, China, Europe, and Japan. For more information, please visit: www.cdnetworks.com