Exploring Content Delivery Networking

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One of the hot topics in the networking industry is content delivery networking. Unfortunately, if you ask five people for a definition of a content delivery network (CDN), you'll probably get five different answers. We hope to clear up some of the confusion surrounding CDNs, discuss how typical enterprise and service provider networks are likely to use them, and describe the business drivers that will fuel their growth in the coming years.

WHAT IS CONTENT DELIVERY NETWORKING?

Several definitions are floating around in the marketplace. Some folks think of it as the delivery of streaming video or television over the Internet or private networks. Others define it as Web switching or content switching. Still others simply see it as a way to improve Web site performance. The truth is, it's a bit of all of these and then some. A CDN is a network optimized to deliver specific content, such as static Web pages, transaction-based Web sites, streaming media, or even real-time video or audio. Its purpose is to quickly give users the most current content in a highly available fashion. The mechanisms and physical equipment used may vary depending on the content.

There are two general approaches to building CDNs. In the *overlay approach*, application-specific servers or caches at various points in the network handle the distribution of specific content types, such as Web

CDNs come in different shapes and sizes, but their success in the marketplace will depend on vendors and providers developing a business justification for their deployment.

graphics or streaming video. The core network infrastructure, including routers and switches, plays no part in content delivery, short of providing basic connectivity or perhaps guaranteed quality of service (QoS) for specific types of traffic. Good examples of the overlay model are the CDNs deployed by companies such as Akamai, Digital Island, and Speedera, which replicate

content to thousands of servers worldwide. These CDNs redirect user requests for Web content to the nearest CDN server, improving Web site response time. Because CDN service providers need not control the underlying network infrastructure, the overlay approach simplifies management and opens new service opportunities. Offering new services using the overlay approach is as simple as distributing new code to CDN servers.

The *network approach*, on the other hand, deploys code to routers and switches so that they can recognize specific application types and make forward decisions on the basis of predefined policies. Examples of this approach include devices that redirect content requests to local caches or switch traffic coming into data centers to specific servers optimized to serve certain content types. Some content delivery designs use both the network and overlay approaches —for example, when a switch at a server farm's front end redirects a hypertext transfer protocol request to an Akamai server located closer to the end user. IP Multicast is a good example of an early network-based approach to optimizing the delivery of specific content types.

WHAT ARE THE MARKET DRIVERS?

During a recent CDN conference in New York, many companies exhibited products and services that allowed CDNs to deliver all sorts of exciting new applications: everything from collaborative tools to games to pay-

More Information

➤ **The Content Alliance presents information about developing content peering standards (http://www.content-peering.org/).**
➤ **The Information Technology Professional's Resource Center (www.itprc.com) recently launched a page on content networking. This page contains links to additional information about content delivery networks and hosts a CDN mailing list.**
➤ **Stardust.com's information page for its CDN conference (http://events.stardust.com/cdn/resources.htm) contains resources on content delivery, including white papers and past session presentations. Stardust.com also offers white papers and other technical information on IP Multicast (http://www.ipmulticast.com/).**

per-view television. The only problem is that nobody seems to have figured out if there is a business case—that is, what are people willing to pay for? Many people can't possibly imagine paying to watch a movie on their PC. Gaming seems to have appeal, but most CDN systems rely on carriers delivering high-speed broadband services with guaranteed service levels to residential customers, something many carriers have found difficult to do in recent years. Given the current focus on path to profitability, these would-be content providers will need to present a clear business case to convince service providers to invest in those applications.

One area where CDN already has a reasonable business case is in Web site performance improvement. For example, Akamai's service provides distributed data (usually, static Web pages or nonlive streaming media) at numerous locations around the world. Redirecting requests to the server closest to the user requesting the information enhances the Web site's overall responsiveness. An origin server, rather than a CDN server, typically handles requests for Web content containing dynamic data. Content providers and enterprises are clearly willing to pay for this performance improvement.

Bandwidth cost, availability, or performance can be an additional business case driver for CDN deployment.

Large enterprises are moving toward providing a CDN infrastructure to reduce the bandwidth costs and constraints encountered when corporate information, such as training videos, corporate news feeds, or even HR forms are accessed from multiple remote sites. Placing content servers at some, or all, remote locations means data needs to go only once to each site. Users can access the data from the local server rather than from some remote corporate data center. This becomes especially attractive for sites that have expensive or limited bandwidth, such as for locations in emerging markets.

WHAT IS CDN PEERING?

Recently, several manufacturers of content delivery devices such as caches and media servers have banded together to create forums and associations to promote the idea of *content peering*. In this model, dozens of service providers and enterprises would create CDNs and peer these networks through as-yet-not-developed standards to provide global content distribution coverage. A new Internet Engineering Task Force working group is already addressing this issue. The driving forces behind efforts to establish content peering standards are hardware manufacturers and smaller CDN providers wishing to compete against industry behemoth Akamai.

The problem with this approach is that service providers don't have a great track record with peering—think of efforts to implement guaranteed QoS across service provider boundaries that have failed miserably. Successful CDN peering requires that service providers deploy billing and management systems that let their networks exchange traffic and enforce service-level agreements. Given many service providers' reluctance to peer unless absolutely necessary, the jury is still out on the future of CDN peering. Such arrangements also rely on a lowest common denominator, so each peer would need to support a minimum set of standards and features. This requirement would limit these peers' ability to introduce new services, because individual service providers depend on other providers to support their feature set across multiple networks.

One area where CDN peering might work is for enterprise customers who are building internal CDNs on their intranet. Enterprises typically use these networks to distribute streaming or real-time video such as e-learning or corporate announcements. Enterprises could theoretically use CDN peering standards to peer their own internal content delivery networks with CDN service providers, making content available both internally and through the Internet to customers or mobile workers.

WHAT DOES THE FUTURE HOLD?

So far, the biggest benefit of CDNs has been in improving the performance of Web sites. Whether content networks become the basis for a new wave of Internet-based services remains to be seen. A killer application is needed to justify infrastructure deployment.

One such application might be music distribution. The current court battles over Napster appear to be waning, and it is entirely possible that the music-sharing service will soon be shutting down—or at least transforming itself

into a pay service. Assuming the Secure Digital Musical Initiative can establish some sort of encryption method that stops illegal distribution of copyrighted material, big music power houses such as BMG and Columbia will likely make their entire catalogs available on a pay-per-download basis. Napster is currently a peer-to-peer service; users download music directly from one another's computers. But if the music companies themselves begin to make their catalogues available online, they'll need to use a content delivery system that ensures their servers aren't crushed under the load of millions of teenagers trying to download the latest Brittany Spears hit single. This prospect alone may require content delivery systems with far more capability than current CDNs. Music companies may also make videos, promotional clips, and other forms of content available to consumers.

Content delivery networking is a broad term that encompasses many different technologies, all with the common goal of improving Internet performance. CDNs have successfully improved the end user experience for millions of Web users. Their emergence as key infrastructure components to support next-generation Internet services will depend on the development of a strong business case for the deployment of such services. ∎

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