

Web 2.0 is Here—Is Your Web Infrastructure Ready?

Executive Summary

The shift from static business-to-consumer (B2C) Web sites to interactive B2C Web sites—essentially the evolution from Web 1.0 to Web 2.0—has paved the way for increased interactivity between businesses and consumers. Those businesses that can deliver on the promise of a more engaging, meaningful, and useful experience have the opportunity to strengthen their consumers' loyalty to the brand. However, without being able to rapidly, reliably, and securely deliver rich interactive content, the benefits afforded by this new level of interactivity will go unrealized.

Many enterprises have long relied upon content delivery networks (CDNs) to help ensure the scalability, performance, and availability of their static Web sites. Unfortunately, traditional CDNs have not evolved to meet the delivery challenges posed by today's sophisticated interactive content.

This white paper outlines today's B2C Web site trends and explains the challenges associated with dynamic content—whether dynamically generated or the result of personalization techniques. The paper also introduces the requirements for the speedy, reliable, scalable, and secure delivery of dynamic content, so that enterprises can maximize the value of their advanced, feature-rich Web sites.

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The Evolution from Web 1.0 to Web 2.0

As companies increasingly rely upon their Web sites to contribute to top-line revenues and maintain brand loyalty, they are finding that sophisticated site functionality and fresh Web site content are critical to maintaining consumer interest and encouraging return visits. Fortunately, today's Web site technologies support these objectives. For example, in an April 2006 eMarketer survey, 27% of U.S. online retailers said they plan to implement interactive tools and 41% intend to use personalization on their sites.¹

A brief look at the evolution of the delivery of content to distributed users provides insight into the reasons that today's Web sites offer a new level of interaction between businesses and consumers. In the 1980s, enterprises relied upon the client/server model to deliver rich content to users. A fat-client GUI played a key role in the consumption of this content. While successful in its own right, this model required a significant investment in administration and infrastructure maintenance.

With the advent of the Internet in the 1990s, organizations could deliver content to a broader audience without these time-consuming and costly maintenance requirements. While the Web interface essentially served as a thin client, the ability to deliver rich content was still limited by Web technologies, Web browser functionality, and end user access speeds. The result is that yesterday's Web sites were mainly composed of static content that rarely changed—each site visitor was largely a passive consumer looking for information.

A closer look at the Yahoo! site offers insight into the evolution of Web content. The original home page, launched in 1994, was little more than a directory listing of hyperlinks (see figure 1). Web visitors would click on the links and read the page content—that was the extent of their online experience.

Today's Web sites, comprising a mix of static and dynamic content, are more dynamic and richer in nature, allowing site visitors to increasingly interact with site content, as evidenced by Yahoo!'s newest design, unveiled in May 2006 (see figure 1). The directory listing is now one of multiple tabs at the top of the page. In addition to browsing everything from news to video, users have access to localized and personalized services such as Yahoo! Messenger, Yahoo! Mail, and Yahoo! Movies.

Rich Internet Applications Bridge the Gap

A new generation of Web applications, called Rich Internet Applications (RIAs)—created using sophisticated technology such as Macromedia Flash, Flex, and AJAX (Asynchronous JavaScript and XML) – enables rich content to be delivered to a far-reaching audience of consumers. According to the Patricia Seybold Group, RIAs combine the usable and desirable rich interfaces that many are accustomed to on the desktop with the reach of a distributed Web application². This development, along with burgeoning broadband adoption (68 percent of U.S. households now enjoy broadband access³) has forever transformed the Web and interactions between businesses and consumers.

Static vs. Dynamic Content

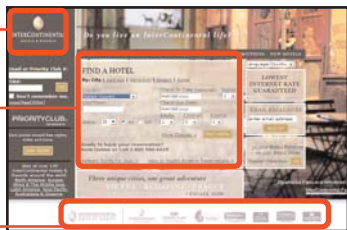
- **Static content:** Static content is typically text and images served as is from cache to a requesting browser.
- **Dynamic content:** Dynamic content changes—due to a program or script—at the time it is requested by the site visitor. Dynamic content, some of which is cacheable, can include personalized content based on information provided by, or known about, the site visitor.

Increasingly, businesses are deploying these rich applications, which consumers interact with directly through their Web browsers. In fact, rich Internet applications have begun to dominate leading Web sites (see figure 1). According to Gartner, by 2010, at least 60 percent of new application development projects will include RIA technology, and at least 25 percent of those will rely primarily on RIAs.²



Figure 1. Yahoo!'s site has become increasingly dynamic over the years

Static Content
Images & Text



Static Content
Images & Text

Dynamic Content
Interactive

This richer content is increasingly dynamic in nature, enabling an unprecedented level of interactivity and personalization. In real time, any consumer-specific information entered into these applications is passed back to the Web infrastructure to enable interaction, further personalization, and compelling marketing offers. For instance, consumers can be presented with geographic- and demographic-specific content, content that is tailored to preferences they indicate, surveys and contests, and constantly updated content such as stock quotes, sales promotions, and news feeds, to name a few.

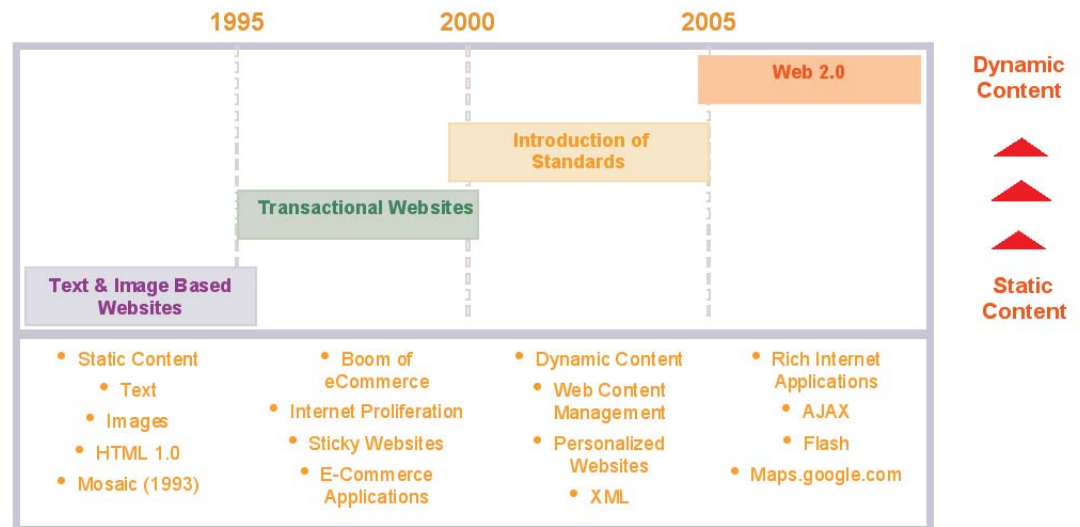


Figure 2. Content is more dynamic and interactive in the age of Web 2.0

The Technology Behind Web 2.0

Whether these applications are developed using Macromedia Flex, Macromedia Flash, or AJAX, they share common characteristics: when site visitors first load their browsers, an advanced client-side Internet application or engine is also downloaded. As the visitor interacts with the Web site, the application or engine communicates with the databases and application servers at the back end Web infrastructure to retrieve small bits of content that are inserted into the page. One example of an AJAX-based application is Google Maps (other AJAX-based Web 2.0 applications include Flickr and Gmail.) Upon first visiting the Google Maps site, the user experiences a delay as the map loads. Each subsequent click on or dragging of the map results in a call back to the application at the data center to update the map.

Examples of Macromedia Flex applications appear on the Ofoto and Red Bull USA sites. Ofoto's Flex application allows site visitors to create and customize their own photo albums online. With a goal of offering a great user experience, Ofoto provides its customers with a rich client application enabling them to create an 80-page book on a single screen. This includes rearranging page layout, and dragging, dropping, rotating, and resizing photos. Red Bull's dynamic rich-media site uses a Macromedia Flash front-end to present engaging and interactive content in a way that mirrors the excitement and energy of the Red Bull brand.

Why Today's Sites Fail to Deliver

While dynamically generated content offers an unprecedented opportunity to engage with consumers, it also presents businesses with a new challenge: the richer content takes longer to load in a Web page. By its very nature, dynamic content is harder—and in some cases, impossible—to cache. As site traffic increases, generating pages on-the-fly for thousands of consumers simultaneously can lead to increased delays—and even failures—in delivering content.

Infrastructure Under Pressure

A rich interactive application itself is a download that must be delivered by the Web infrastructure. While most companies point to the small file size associated with the subsequent data calls, the back-and-forth interactions between the consumer and the Web infrastructure are themselves subject to the performance and reliability vagaries of the Internet.

For instance, while AJAX reduces the delay in the interaction between the browser and the display of a page when new data is retrieved from a Web server, an AJAX implementation suffers from the same issues that afflict traditional Web application implementations using browsers as their user interface. These issues include performance concerns around scripts within the Web browser, and latency/bandwidth issues between the browser and server. For example, AJAX applications require a number of TCP connections to potentially be open at any one time, and affect server loads and bandwidth requirements due to continuous content refreshes.

Whether the content is delivered via dynamic AJAX, XML, Macromedia Flex, or some other sophisticated design or programming language, delivery of this content and applications places greater stress on the Web infrastructure.

Furthermore, most enterprises host their application servers locally, even though their consumer base is distributed nationally or even internationally. Unfortunately, due to Internet problems outside of the control of a centrally hosted Web site, the consumer may not be able to access an application or may experience poor performance. These problems tend to be exacerbated when a large number of consumers attempt to access the application simultaneously.

Consumers Are Demanding

On the consumer side, the main concern is the quality of user experience and they expect a high-performing and reliable Web site. While many businesses may believe they are effectively managing their Web sites and meeting consumers' needs, in a 2005 survey of 600 leading Internet brand sites across multiple industries, Forrester Research analysts reported they were frequently hampered by sites that were frustratingly slow, prone to bizarre errors, or inexplicably offline.⁴

Poor performance or an unavailable site or application—whether the cause of a Web attack or a Web site's inability to efficiently serve rich, dynamic content to distributed consumers – is unacceptable and can negatively impact brand perception and revenues. In an April 2006 survey of 1,058 consumers, Jupiter Research and Ipsos-Insight found that poorly performing sites suffer damaged reputations.⁵

In the same Jupiter Research/Ipsos-Insight research, the results show that—next to price and shipping issues—poor site performance leads to dissatisfied shoppers and site abandonment. 64% of respondents said they would be less likely to return to a site that performed inadequately and 62% said they would likely not purchase again from the company online.⁶

Traditional CDNs Fall Short

To ensure customer loyalty and to capitalize on all revenue-generating opportunities, businesses must deliver a high-quality and reliable consumer experience without fail. In fact, consumers have come to expect this after so many years of being served high-performing static content via content delivery networks (CDNs). While many of today's leading businesses rely upon traditional CDNs to help them ensure fast and reliable delivery of their Web images and text, these CDNs have not evolved to support rich interactive content. One key factor is the restricted geographic distribution and size of these networks—this limitation prevents CDNs from routing traffic efficiently around Internet congestion. Just as important, traditional CDNs have not developed the advanced technology needed to cache and accelerate dynamic content. Without these capabilities, traditional CDNs are unable to address the unique business requirements of transactional and highly interactive Web 2.0 sites.

Key Considerations When Serving Dynamic Content

Businesses familiar with CDNs are often under the impression that dynamic content is uncacheable. While this is true of some types or aspects of dynamic content, it is not true for all dynamic content. For instance, the output caching generated by databases and application servers is cacheable, as are search results and product catalog pages (assuming that no real-time inventory checks are occurring), to name a few. As long as the page output is the same for every site visitor (or for groups of visitors with a unique identifier, such as a cookie value, accompanying their requests), even dynamically generated content can be cached.

In order to satisfy consumer demands and business requirements for rich, interactive content, businesses must seek a solution that helps them address the unique challenges associated with the delivery of dynamic content. At a minimum, the solution must support the following:

- **Static and Dynamic Content Caching:** Any content suitable for caching at the edge of the Internet can help offload the origin server. In addition, a large globally-distributed network can speed up content delivery by caching content close to the end users.
- **Content Prefetching:** The solution should be able to pre-load dynamic content on its servers before the user has started requesting the content. For small cacheable images, prefetching can boost performance by placing disk-based objects into memory ahead of time, enabling B2C Web sites to more rapidly serve dynamically-generated pages.
- **Route Optimization:** The ideal solution will determine the optimal Internet path for dynamic content by avoiding Internet problem spots. By sending application transactions over Internet paths that are fast and reliable, the end user experience is enhanced.
- **Connection Optimization:** Once an optimal route is selected, the connection should be further optimized using a combination of protocol optimization, persistent connections, and compression to further boost the performance of dynamic content.
 - Protocol optimization:* Standard TCP parameter configurations often introduce unnecessary latency. The solution must be able to boost application performance by, for instance, reducing the number of round-trips necessary to deliver a page and tuning the infrastructure to better handle packet loss.
 - Persistent connections:* The solution should support persistent connections, which reduce the time spent establishing and disabling TCP connections. Persistent connections are critical for the transmission of smaller messages where more time is spent setting up connections than transmitting data.
 - Compression:* The solution should be capable of compressing the large number of files—such as JavaScript and CSS—that are communicated in the initial download of data to the browser. Compression can reduce bandwidth requirements and speed up content delivery to end users with limited bandwidth, such as those on a dial-up connection.
- **Internet Storage:** By moving the content involved in the initial downloads from the origin server to storage on the edge of the Internet, the solution can offload hits from the origin. This in turn can increase the speed at which content is retrieved for delivery to requesting users.

Akamai Accelerates Web 2.0

Akamai, the leading global service provider for accelerating content and business processes online, continually evolves its delivery services to keep pace with the evolution of Web sites. Originally developed to ensure the speedy and reliable delivery of static content, Akamai has created new services that help enterprises address their 21st-century content and application requirements.

Akamai's Dynamic Site Solutions address the unique challenges associated with delivering dynamic content, accelerating both the download associated with today's dynamic applications as well as the interaction between the consumer's browser and the origin site. Dynamic Site Solutions are built on Akamai's EdgePlatform, a massive network of 18,000 servers in more than 1,000 networks in 69 countries, enabling enterprises to extend their B2C Web sites and applications to the Internet edge, thus bringing content close to consumers. Additional performance improvements are gained through the use of connection and path optimization techniques that dynamically avoid problem spots on the Internet. The result for each Web site is higher availability, superior performance, and greatly increased scalability.

Benefits of Dynamic Site Solutions include the following:

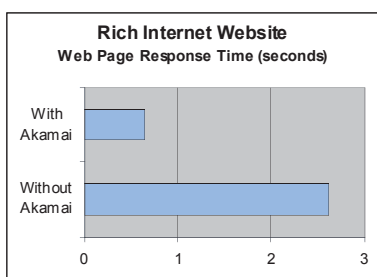


Figure 3. Testing shows that, rich interactive Web sites were delivered more than 4X faster with Akamai's Dynamic Site Solutions

- Speed:** Dynamic Site Solutions accelerate the delivery of both static and dynamic, application-generated content, even if it is uncacheable. This includes selecting a fast and reliable path from the Internet edge back to the customer's application server to accelerate the data and calls between the browser and the origin. The solution can even manage application data calls from the edge of their network, such as for infrequently changing data that is not time-sensitive and can apply these technologies to dynamic content associated with personalization. Additionally, Dynamic Site Solutions can increase the effective download speed of application content to consumers, as well as accelerate the display of the entire page, regardless of its composition. Dynamic Site Solutions dramatically improve the delivery of dynamic content whether compared to the performance of the Web infrastructure or to a traditional CDN.
- Scalability:** The solution absorbs customers' peak traffic, regardless of the number of site visitors or their location, and eliminates as many calls back to the origin as possible. The globally distributed EdgePlatform along with advanced technology and servers close to consumers enables this and relieves businesses of the need to purchase additional infrastructure
- Availability:** Regardless of what type of content a business is serving from its site, the site must be available for consumers to take advantage. Unfortunately, Internet outages—beyond the control of any single Web site—are unpredictable and potentially costly in terms of revenues and customer loyalty. Dynamic Site Solutions identify and avoid Internet problems by leveraging Akamai's globally distributed network of servers coupled with advanced intelligent routing technology. Akamai also offers a failover option, whereby dynamic content can still be delivered in the event that the origin site is unavailable.
- Security:** As sites and applications are increasingly at risk of outside attacks, businesses must ensure uptime without having to add expensive equipment, software, and personnel, or deploying mirrored sites. Dynamic Site Solutions uses techniques such as dispersing distributed denial-of-service (DDoS) attacks, cloaking the customer's origin infrastructure from the public Internet, and bypassing bottlenecks to deliver content and applications with the greatest speed and reliability, even in the face of attacks that affect the performance of the entire Internet.
- Control:** To fully benefit from extending dynamic content and rich Internet applications across a distributed network, a business must be able to control how its content is being delivered, cached, published, and routed on the extended infrastructure. Akamai enables customers to configure how their content is cached and served, and provides reporting and alerting tools that deliver insight into how the company's extended content and application infrastructure are functioning at all times.

Akamai's Dynamic Site Solutions provide these benefits for all content types—static HTML, images, application-generated dynamic content, secure content, personalized content, and software and document downloads—while allowing the enterprise to retain control over how this content is deployed and handled on the Akamai EdgePlatform.

To learn more about how Akamai can help your business accelerate dynamic content and take advantage of Web 2.0, contact us at 877-4AKAMAI or visit our Web site: www.akamai.com.

About Akamai

Akamai® is the leading global service provider for accelerating content and business processes online. Thousands of organizations have formed trusted relationships with Akamai, improving their revenue and reducing costs by maximizing the performance of their online businesses. Leveraging the Akamai EdgePlatform, these organizations gain business advantage today, and have the foundation for the emerging Web solutions of tomorrow. Akamai is “The Trusted Choice for Online Business.”

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