

AKAMAI WHITE PAPER

Unlocking Mobile Application Performance

Overcome Mobile App Performance
Barriers with the Right CDN



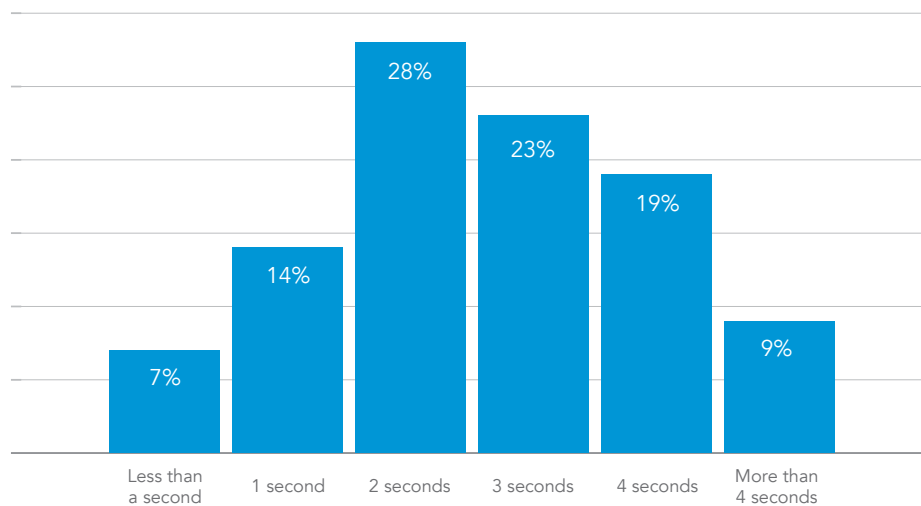
Introduction

As mobile device usage has skyrocketed in recent years, mobile applications have emerged as the key engagement channel for businesses to connect with their most loyal and most valuable customers. Mobile app usage represents more than 85% of total mobile device time,¹ and users now spend more time with apps than they do with television.² But while app usage has increased more than 60% over the last two years, the number of apps each user actively engages with has remained fairly steady, at around 27 per month.³ This means users have a limited appetite for additional apps – but are heavily engaged with the ones they use. So while the mobile web gives businesses broad reach, mobile apps offer a robust link to their best customers.⁴ Users who value the company enough to go through the trouble of downloading and installing the app are a brand's most engaged audience and loyal fan base.

Predictably, app users' expectations are high. In Dimensional Research's recent global survey of mobile app users, 96% of respondents said that app performance was important, with 61% expecting apps to load within four seconds and 49% expecting apps to respond within two.⁵ According to Forrester Research the performance bar is even higher, with a guideline of one-second response times for mobile apps, regardless of network conditions.⁶ In the web world, performance translates into happier users, longer engagement times, more views, and lower abandonment rates – delivering business benefits ranging from increased revenue to greater brand loyalty. In the mobile app world, the effects are analogous but the stakes are even higher, since users stay loyal to very few apps and performance is a key determining factor. Dimensional found that nearly half of users would uninstall an app that ran slowly.⁷ Moreover, slow-performing apps not only result in actions against the app – such as abandoning, uninstalling, or leaving a negative review – research shows they can also lead to actions against the brand – like spending less or switching to a competitor.⁸ Simply put, when it comes to apps, speed is paramount.

49% Expect an App to Respond in Two Seconds or Less, Setting a New Benchmark

In your opinion, how fast should an app respond?



Source: Dimensional Research, Mobile app usage and abandonment survey

Key Barriers to Mobile App Performance

While consistently fast performance is critical to any mobile app strategy, achieving such levels of performance is unfortunately even more complicated than in the web and mobile web world. Mobile applications offer developers the ability to create richer, more engaging, and more immersive experiences than mobile websites can, but the tradeoff is a more complex environment that can be difficult to measure and optimize – and carries its own unique set of performance challenges. We examine the key barriers to mobile app performance below.

Highly Variable Last-Mile Conditions

On the network side, the weak link in mobile performance is generally the “last mile” – the connection between the mobile device and the Internet. Sometimes the last mile is relatively fast (a strong Wi-Fi connection), while other times it can be an infuriatingly slow (a spotty 2G or 3G link). In many cases, it changes frequently, as mobile users are frequently on the go. Cellular connections, which currently comprise about 38% of all mobile access on the Akamai network,⁹ are particularly challenging. They not only are subject to high latency, but also suffer from highly variable congestion rates – even on relatively fast 4G networks – resulting in uneven end-user response times. This makes it difficult for mobile app developers to deliver the consistent, high-performance experience their users want.

Increased Reliance on APIs and Network Connectivity

Despite mobile apps’ thick-client architecture, their performance is increasingly dependent on network conditions, as they rely more and more on APIs to deliver real-time content and richer, more interactive experiences. Between 2015 and 2016 alone, API traffic on the Akamai network doubled and now accounts for more hits – and nearly twice as many bytes – as HTML traffic. Unfortunately, though users are aware that slow networks can impede performance on the mobile web, in the case of mobile apps, they are more likely to blame the app itself rather than the network.¹⁰ So, in order to provide a responsive experience that keeps users happy, app developers need a way to boost the performance of their dynamic API calls.

Complex Rich-Media Requirements

Images and rich media are critical to any mobile experience, but optimizing for quality and performance is difficult due to the extreme diversity of device sizes, aspect ratios, and display resolutions – in addition to the aforementioned frequently changing last-mile network conditions. Additionally, handling the wide variety of display situations typically requires creating, storing, and managing a large catalog of derivative files for each image an app uses. This operational burden is resource-intensive, error-prone, and can force some organizations to settle for delivering less-than-optimal mobile app experiences to their users.

Lack of Network-Aware Intelligence in Apps

As discussed above, last-mile connectivity issues represent one of the biggest barriers to mobile performance – and, by extension, an engaged mobile audience. Mobile users often move in and out of coverage, and their available bandwidth at any given moment is highly sensitive to changes in radio tower connections, signal strength, interference, and the number of users sharing a local connection. However, most mobile apps today are not network aware, meaning they always operate under the assumption that a reliable network connection is at their disposal. When this isn’t the case, the mobile app experience degrades quickly – or the app stops functioning altogether. Unfortunately, even the best network-side acceleration technologies cannot always overcome a poor-quality mobile connection. To deliver a consistently compelling user experience, apps need to be network aware and use intelligence about the real-time speed and quality of their network connection to adjust accordingly and provide instant-on experiences across continually changing conditions – even when the device goes offline.

EVERY DAY, AKAMAI
ACCELERATES MORE THAN

200
BILLION
API CALLS

1.5
TRILLION
IMAGES

Challenges in Measuring Performance

Despite the critical importance of app responsiveness, most organizations do not have adequate tools for measuring app performance. While some synthetic performance-monitoring solutions exist, they are a poor substitute for real-user measurements given the complex nature of mobile applications as well as the highly variable last-mile conditions they operate in. Moreover, unlike in the web and mobile-web worlds, there are no standardized metrics for measuring app performance. Web metrics like time to first byte and total download time are still relevant but need to be properly interpreted in terms of their effect on the mobile-app user experience as well as their business impact. Finally, performance monitoring and mobile optimization go hand in hand, and solutions should address both sides in a tightly integrated way to help developers consistently deliver the best possible experience to their users.

Improving Mobile App Performance with the Right CDN

Mobile apps have typically been developed with device limitations like memory and processing power in mind, but as we have seen above, apps increasing use of server-side data means there is a significant part of app performance that relies on the network – and factors like Internet connectivity, cell tower congestion, and mobile network speeds. This means many of the performance barriers mobile apps now face depend on factors outside of the developer's immediate control. Fortunately, there are still effective ways of overcoming these obstacles.

In the web world, organizations have long leveraged Content Delivery Networks (CDNs) to help improve performance over the Internet. Some of the capabilities CDNs provide can be extended to boost mobile application performance as well, but the best results require augmenting network-based optimizations with in-app optimizations. This means using a CDN with a mobile acceleration platform that extends not only to the distributed edge of the Internet but also all the way to mobile devices themselves, via a network-aware mobile application SDK (or Software Development Kit). More specifically, the right CDN must have the following key characteristics:

- A highly distributed network that extends into the cellular edge of the Internet
- Intelligent platform services tailored to accelerating the API and image calls that mobile apps heavily rely on
- On-device, network-aware capabilities that enable apps to deliver better user experiences across changing network conditions
- Customizable real-user app performance monitoring that ties performance metrics to business objectives

We now look more in depth at each of these key pieces in a mobile app performance solution.

Cellular Edge Deployment to Tame the Mobile Last Mile

Because high last-mile latency is often the culprit in network performance for mobile apps, it is critical to partner with a CDN that delivers content to mobile cellular users from servers that are as nearby as possible. Unfortunately, many CDNs do not have a highly distributed network, so their servers sit far away from most mobile gateways, increasing latency across the last mile, and, in turn, slowing end-user performance. In contrast, the right CDN will deliver mobile content from servers that sit close to the user's mobile gateway – or even better, from within the mobile network core itself, thus also bypassing gateway congestion.

Even greater speed boosts can be achieved when mapping intelligence is extended to the device itself (via an SDK), resulting in greater accuracy in choosing the fastest nearby server region. This type of in-app intelligence, combined with a network deployed at the cellular edge, can boost mobile cellular users' download speeds by an additional 20-25% on top of already accelerated content delivery speeds.

Mobile API Acceleration

Because mobile apps rely on frequent API calls for both content and transactional capabilities, API performance is a crucial piece of the app performance puzzle. While the APIs used by mobile applications are highly dynamic, sophisticated CDNs can accelerate API performance in several different ways.

- 1. An advanced caching platform.** Many types of dynamic API responses are actually cacheable. Those returning product descriptions, store locations, or search results, for example, can be cached using the query parameter as part of the cache key. Additionally, time-sensitive content, like the news updates and weather reports, can also be cached and kept up to date using a CDN's fast purge capabilities whenever new content is published. Caching API responses wherever possible improves performance significantly for end users and also offloads the API server, allowing it to gracefully handle peak loads and unexpected demands.
- 2. CDN dynamic site acceleration techniques.** For uncacheable APIs, techniques like compression, intelligent routing, and transport protocol optimization - can provide substantial performance boosts. For both cacheable and uncacheable APIs, however, it is worth remembering that a highly distributed network with deployments at the cellular edge is necessary in order to deliver strong, consistent performance increases, for the reasons discussed above.
- 3. API-focused capabilities** that contribute to a better end-user experience and reduce complexity for the developer. Advanced CDNs can offer the ability to apply throttling and prioritization policies when the API server is overloaded, handle backward compatibility when rolling out new API versions, and provide user authentication for API requests – all at the edge of the network, without burdening the origin server.
- 4. Leverage performance benefits for the Internet's evolving technologies** as quickly and effortlessly as possible for all types of communications, including API traffic. Because of the Internet's highly heterogeneous nature, protocol and technology upgrades tend to roll out over months or years, with uneven support across networks, devices, and platforms. The right CDN smooths this transition for organizations, enabling upgrades like HTTP/2 (including server push), IPv6, or the ChaCha-Poly cipher suite (for speeding up SSL on mobile devices) whenever they are properly supported by the end-user's device while also fully supporting older devices and prior protocol versions – and working around implementations with known bugs or incompatibilities. In addition, the right CDN automatically optimizes communications based on whichever protocol version is being used – HTTP/1.1 communications require different optimizations than HTTP/2 communications, for example. Thus, as the mobile web evolves, developers can take advantage of new technologies' benefits as quickly as possible, without having to make server or application code changes.



68%

speed boost seen for
mobile cellular users after
Akamai enabled HTTP/2

Image Optimization and Management

In addition to image caching and acceleration, advanced CDNs can greatly reduce the headaches involved in optimizing media for the countless variety of mobile devices, browsers, and networks in use today. A single image asset in a mobile app can require anywhere between dozens and hundreds of derivative versions in various resolutions, aspect ratios, compression qualities, image formats, and even background colors. With the right CDN partner, content producers can focus exclusively on creating the original images – offloading to the CDN the resource-heavy tasks of generating, storing, managing, and delivering the images in a form that is optimized for each end-user's device. Advanced CDNs can also leverage each user's real-time network congestion conditions to further compress images when needed, ensuring a responsive app experience without sacrificing perceived image quality.

Network-Aware SDK

While network-based optimizations such as those discussed above will go a long way towards improving mobile app response times, there are times in which even the best network optimizations are not enough to overcome poor network conditions. These situations require intelligent decisions made from within the mobile app itself, enabled by an SDK that extends the CDNs network-aware optimization platform all the way to each mobile device. Such an SDK makes it easy for developers to build apps that function fluidly in the face of continually changing connectivity conditions – even if the device goes offline. With real-time network awareness, apps can do the following:

- **Optimize local app behavior based on current network conditions.** The app may choose not to check for updates or to delay third-party API calls if network congestion is high, for example. It may also choose to default to locally stored content until network conditions improve.
- **Tailor server-side responses based on current network conditions.** For instance, the server may return a smaller list of search results or a pared down set of product recommendations when the mobile-user's network quality is poor. Network-aware hints can also be used to guide the CDN on how much compression to use when delivering images.
- **Periodically push information to the device when the network quality is good,** providing an instant-on experience with up-to-date content the next time the user engages with the app. A retail app, for example, could push new promotions or personalized product recommendations, while social media apps could proactively load updates from friends and followers.
- **Intelligently pre-position rich media and other content onto the device while it is on a Wi-Fi connection** so the content is readily available on the device later, even when the device is offline or on a poor-quality connection. For example, a news app can pre-position breaking news or most-watched video clips as well as top stories in topics the user is interested in. In addition to improving app experience, pre-positioning can also reduce the mobile-user's data plan consumption by opportunistically pre-loading videos and other rich content over Wi-Fi instead.

Network-aware apps, when used in conjunction with network-based optimizations for accelerating API calls and image downloads, set a new bar for offering consistently rich and compelling user experiences across a wide range of network conditions – even rapidly changing ones.

Business-Driven Performance Monitoring

A mobile app performance optimization solution is not complete without the ability to measure, monitor, and improve the business impact of performance. This is best achieved via a streamlined SDK that offers real user monitoring in addition to the performance-enhancing capabilities discussed above. Beyond capturing key network and device data for each API call – including time to first byte, total download time, battery level, carrier, connection type, and cache status – the SDK should enable easy tagging of custom events. Custom event tagging will allow for a better understanding of the actual user experience by associating sets of API calls with business-defined actions that are unique to a business. These custom tags may be loading the initial app screen, logging in, or completing a purchase or any other event that matters to the app owner. Unlike the mobile web, in mobile apps there are no base HTML pages to tie standardized metrics to, so the ability to connect API calls to customized actions allows organizations to measure and improve app performance in alignment with the business metrics and goals they care most about.

Conclusion

The right CDN – one with all five key characteristics above – can help organizations overcome the complexity of continually evolving mobile environments to deliver consistently compelling app experiences to every user, every time. Such a CDN must have both the right network deployment and the right platform services – providing network-aware intelligence not only throughout the CDN network but also on each end user device – to enable streamlined measurement and delivery of optimized user experiences across fast-changing network conditions. With such a solution, organizations can overcome challenging mobile app performance barriers – enjoying more users, higher engagement metrics, and ultimately more revenue and greater brand loyalty as a result.

Case Study: Accelerating User Growth through Improved App Performance

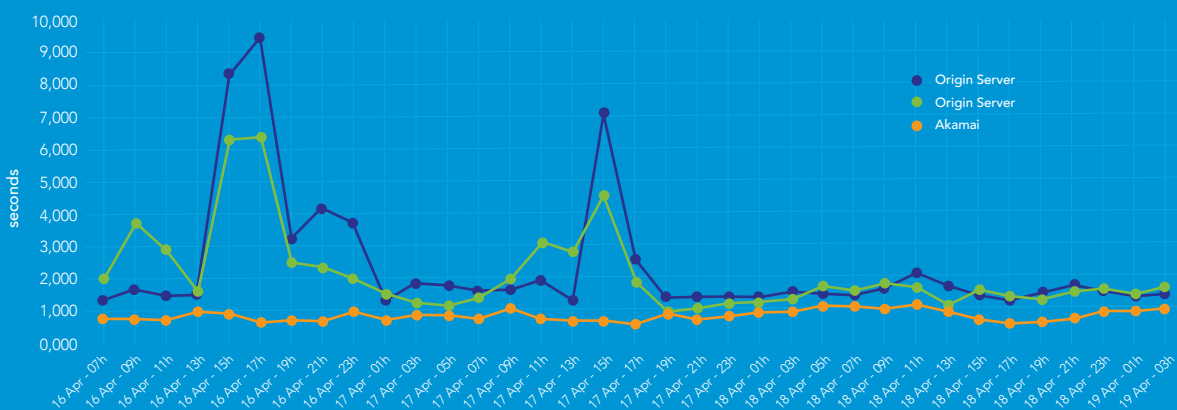
Launched in 2012, Beijing-based Blued is the world's most popular social network for the gay community, with over 15 million users worldwide. After seeing great success in China, in 2015 Blued decided to expand its business globally into North America and Southeast Asia but needed a way to ensure a consistently fast app experience for all of its global users.

Blued offers mobile apps on the iOS, Android, and Windows platforms. As a location-based social app with significant user-generated and time-sensitive content, Blued's apps rely on frequent, non-cacheable API calls to a JSON-based backend. With only two data centers (one primary, one backup), both based in Beijing, Blued suffered from significant global performance and availability issues and chose Akamai to help them solve their user-experience challenges.

After implementing Akamai Ion to accelerate their API calls and speed up transactions such as user registration and login, Blued saw global performance improve by 153% — and performance became far more consistent from session to session throughout the day. Even more compelling was the significant uptick in user growth Blued enjoyed starting immediately after implementation. In addition, user satisfaction and app engagement time both increased significantly. Blued also reported that by using Akamai, their team was able to focus its resources on designing the core experience, rather than dealing with the myriad technical challenges of ensuring that experience would be delivered in a fast and consistent way to every user around the globe.

Performance Comparison for Blued Mobile App

With Akamai, Blued's mobile app performance improved by 153% globally -- and became far more consistent.



About Akamai

Akamai accelerates over 145 TB of mobile app data every day, helping thousands of organizations engage and delight their VIP customers through high-performance mobile apps running on the Akamai Intelligent Platform™. Combining a sophisticated, network-aware platform with industry-leading cellular edge deployments and mobile optimization capabilities, Akamai continues to offer savvy businesses the most innovative mobile performance solutions for today and tomorrow.

Source

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As the global leader in Content Delivery Network ([CDN](#)) services, Akamai makes the Internet fast, reliable and secure for its customers. The company's advanced web performance, mobile performance, cloud security and media delivery solutions are revolutionizing how businesses optimize consumer, enterprise and entertainment experiences for any device, anywhere. To learn how Akamai solutions and its team of Internet experts are helping businesses move faster forward, please visit www.akamai.com or blogs.akamai.com, and follow @Akamai on [Twitter](#).

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