

Best Practices:

How to Evaluate and Implement a Multi-CDN Strategy

GlobalDots



About This eBook

We have encountered numerous questions from our clients and contacts about the specifics of CDN technologies.

This guide is an effort to explain most of the features, benefits, and technical details about CDN – how to utilize it for maximum ROI, how to select your vendor, what to look after in terms of pricing, use case, and so on.

GlobalDots is a 17-year world leader in web & cloud innovation, and among the world's biggest independent technology partner for Web Performance and Content Delivery solutions.

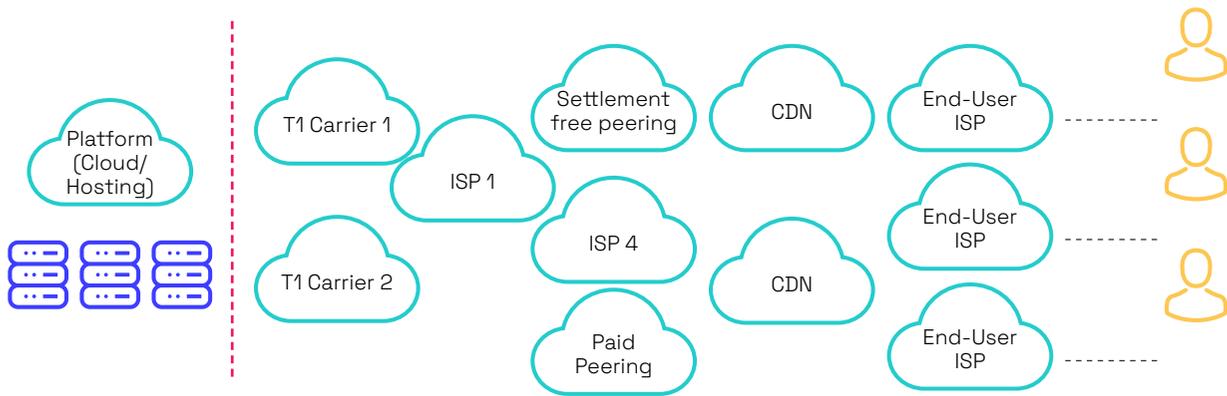
Certified by the world's leading CDN & cloud providers, our solutions engineers provide hundreds of global enterprises and fast-growing companies with hands-on implementation and advanced professional services.

Our teams of security, cloud economy and DevOps experts allow us to deliver holistic solutions for lean, scalable IT ecosystems, to support business growth in the constantly changing technology & threat landscape.

01. The Web Has Evolved, and Performance is King

Running a global high-performance Web platform has never been more challenging. Web operators must contend with tuning site delivery to perform equally well from Beijing to Boston, Savannah to Sao Paulo. Site owners must also deal with accelerating device proliferation and social media-induced traffic spikes. While website performance now influences whether a quarter's revenue numbers are made or missed, it is also difficult to stay a step ahead of your customers' expectations. Today's online content creators need to manage expectations for a global Internet user base that now reaches over two billion people – 30% of the world's population.

Figure 1: Internet Infrastructure is Complex and Constantly Evolving



Peering relationships come and go, ISPs merge and ASNs disappear.
CDNs and clouds change their transit policies.

The explosion of the mobile Web is even more astounding. According to a Statista report, there are currently [15 billion mobile devices](#) operating worldwide - while the planet's entire population is estimated at 8 billion. And, mobile Internet users aren't cutting Web operators any slack. In a recent study, over half indicated that they expect mobile sites to load as quickly as their home computers.

Content Provider Considerations

Multi-channel access methods for websites are not the only items a content owner must consider; demographics and the site's purpose also come into play. Most shoppers state that they will leave a page if it takes more than three seconds to load, while Radware reports the median "time to interact" is 4.9 seconds. Aberdeen research has quantified the impact: Each second delay in load time means 11% fewer page loads and 7% fewer conversions⁵, and the bigger your eCommerce or media property, the greater the damage. For the largest properties, this can mean millions of dollars in lost revenue. Radware finds "57% of consumers will abandon a page that takes longer than 3 seconds to load."

Performance Means Business

If a decline in performance leads to lost business, then it should follow those performance improvements to increase business, which has proven to be true. This correlation has been demonstrated in that a faster page load-time leads to more frequent and longer visits and fewer bounces. Mozilla provides a compelling real-life-use case: Through optimizing their Web pages, they boosted conversions by 15%, leading to a potential increase of over ten million downloads.

It should be noted that improving performance increases a site's conversion rates and has a significant impact on search engine rankings. Google includes overall site speed as part of its Page Rank algorithm. Improving your Web or mobile applications' performance is an ongoing process. Simple methodologies we recommend to all our customers to meet availability and performance goals are:

- ▶▶▶ Monitor and measure your current strategy
- ▶▶▶ Make informed decisions about extending infrastructure
- ▶▶▶ Mitigate your risks as you implement changes
- ▶▶▶ Rinse and repeat

02. Delivery Platforms: Reasons for a Multi-CDN Strategy

In response to these increasing performance demands, the last few years have seen a significant wave of innovation in content delivery platforms. This has largely taken the form of more vendors coming to market with increasing levels of specialization. One thing is clear, however, adding delivery partners increases performance and provides significant value. In audit after audit, our data shows that clients lower latency using multiple CDN federation as compared to single-CDN use.

Figure 2: Virtuous Cycle of Application Improvement

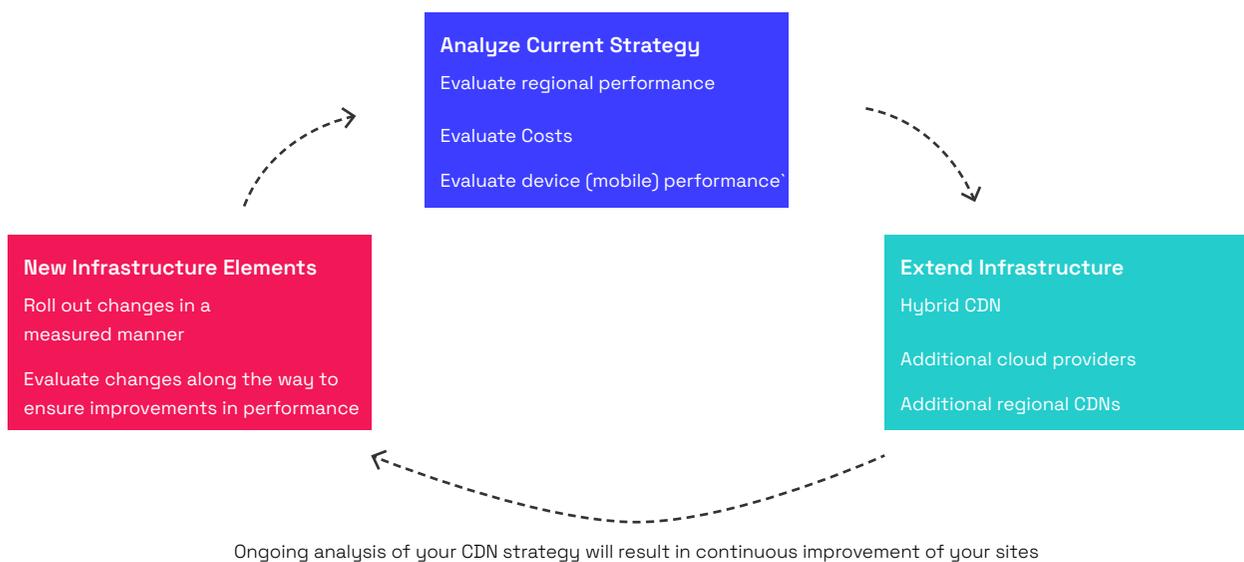
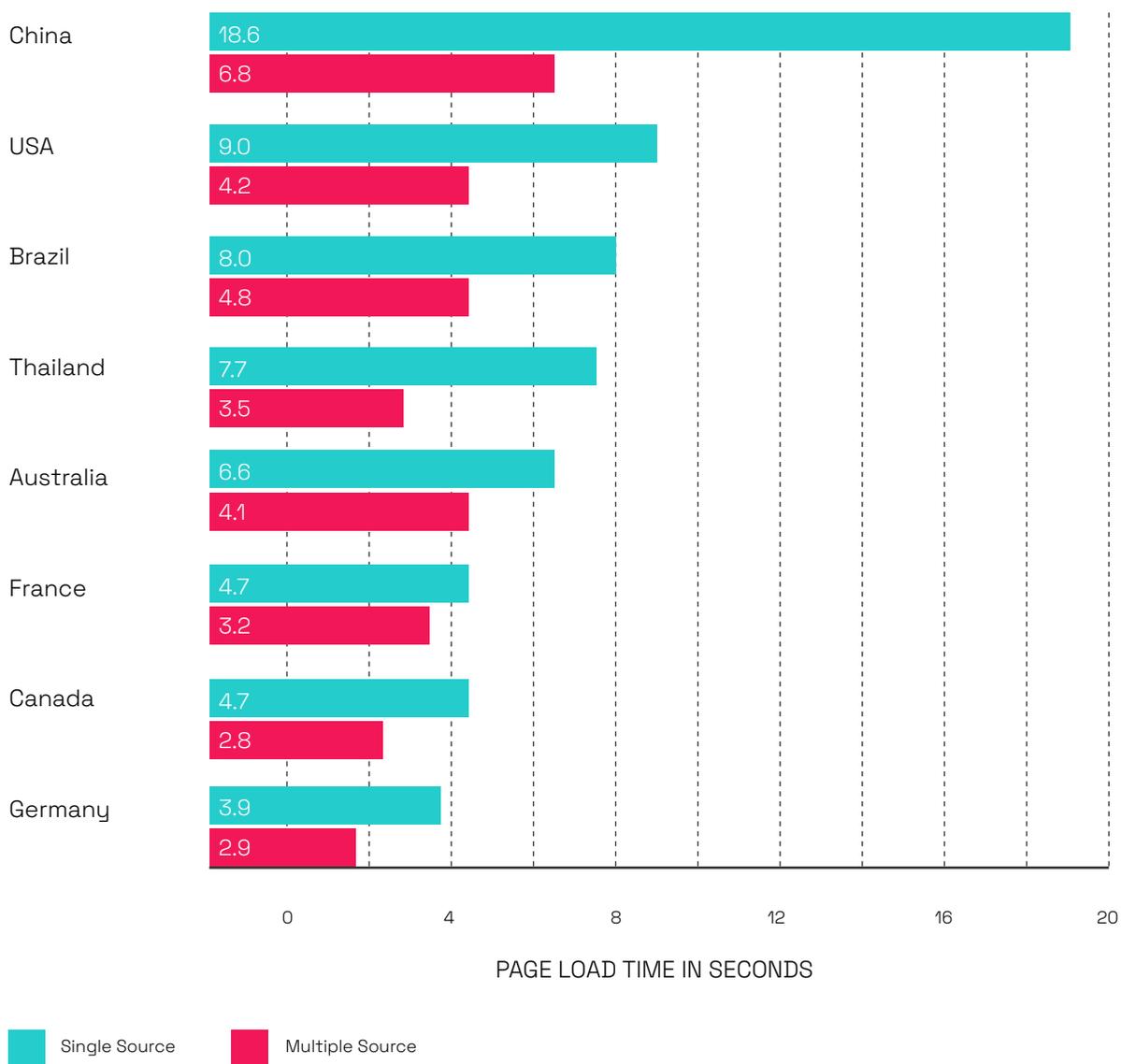


Figure 3: Single vs. Multiple CDN Comparison



*Actual customers results

Throughout the world, multi-CDN strategies improve performance.

As CDN providers specialize in addressing specific audience locales, demographics, content types, and device types, the market has become increasingly complex. We can expect this trend to continue. It requires online managers to navigate a convoluted and rapidly evolving provider landscape to get the coverage and performance they need.



A Hybrid Approach

The assorted CDN providers have varying strengths and weaknesses about their peering/paid transit with ISPs and backbone networks. CDN providers also have differing levels of features and performance concerning different traffic types.

While a single provider may offer a “good enough” service to most audiences most of the time, content providers have learned that no one platform can offer the best performance everywhere, all of the time for all traffic types.

As a result, many content providers are now moving toward a hybrid approach to content delivery services. They are taking this action to develop and improve their performance capabilities, avoid vendor lock-in, and ensure they can maintain the flexibility they need to continue to keep up with their end users’ demands. In addition, as they expand their businesses to new geographies or more dynamic applications, they need local partners to ensure excellent performance for their new customers.

Selecting a Strategy

So, which platform partners are the best ones to choose, based on your markets and the demographics of your user population? The best solution is actually to use several providers that, when combined, offer a fully rounded delivery solution on a global scale. This ensures a 24/7 best-of-breed coverage for all of your customers, leveraging the providers’ strengths and minimizing their weaknesses.

The sections below will help you formulate the questions you need to establish the most optimal mix of platform providers for your specific business goals and effectively take advantage of the delivery options available to you. Your business is unique, so don’t expect a one-size-fits-all set of answers. Instead, consider the specifics of your business and how Web performance applies to you and your customers.

Eliminating the Single Point of Failure

It would be remiss to leave this section without talking about the other obvious advantages of a Multi-CDN solution. Performance is a great goal, but removing your single point of failure (SPOF) is an equally laudable benefit. Any system architect knows that a SPOF will eventually knock you offline. While CDNs are built to be redundant and have certainly improved over the last 10 years, there can be no doubt that CDNs have occasional technical challenges that can affect website performance. By moving your mobile app or Web property to a multi-CDN delivery strategy, you make your entire system more resistant to failure.

Negotiating from Strength

Lastly, by adopting a Multi-CDN approach, you provide your business executives leverage when negotiating CDN rates. This is no small matter. CDN companies, like all companies, want to maximize their value by resisting price decreases. CDN transit rates for new contracts have declined 15–25% each year, according to Dan Rayburn of StreamingMedia.com. To take advantage of annual rate drops, an enterprise must have realistic options; in other words, multiple CDN partners. Some CDNs meet this requirement.

03. Two Rules for Effective Hybrid CDN

Rule #1: Own your origin

To have the ability on your site to allow multiple CDNs to cache your content, you must first understand your current delivery ecosystem. The business logic that may live on parts of the CDN has to be pulled back and implemented on the origin.

Here are four important things to look for concerning this issue:

1. Establish your origin outside of the CDN itself.

If your CDN does not allow its storage to be used as third-party origin storage, best practices would be to have multiple origins (at least a primary and a failover). Multiple geo-located origins may be good for larger sites or mobile apps with high data needs (online gaming, for instance). These origins can be load balanced as well for performance and availability. An example of this strategy would be a company that executes origins on the East Coast, West Coast, Europe, and Asia.

2. Limit the number of features that you utilize with a specific CDN.

Put the intelligence in your origin, where possible; that's your value proposition. Attempt to use CDNs only for delivery. By pulling the business logic back into the origin and performing these tasks yourself, you have set the table for multiple CDN delivery

3. Limit the use of CDN origin storage.

This will have to be replicated across multiple CDNs if you use it. Rather, opt for using cloud storage in multiple locations or setting up your storage near your own origin(s).

4. Make sure all your content uses best practices for caching.

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Caching is a long and complex topic, but the following rules are a good start:

- ▶▶▶ Usually, **the first 90%** of the content is easy to cache; it's the last 5-10% that's tricky. Focus on the 90% first:
 - ▶▶▶ Spend time reviewing the site and **categorizing content**. This will help when you need to set cache rules.
 - ▶▶▶ Know what your audience is looking at by object. Fav.ico is usually the most requested component, and then comes the logo and CSS, JS, and page furniture. Tackle these first.
 - ▶▶▶ Be cognizant of pages that are made up of components. Simply not caching anything in the / homepage directory because the base HTML is dynamic. One strategy that many sites have deployed is **domain sharding**. This is simply the act of creating and using separate CNAMEs for domain names within the page and allowing the browser to download the different resources from different domains. We talk about this a little more below, in case this is a strategy you have deployed on your Web property.
 - ▶▶▶ Rarely are images not cacheable or cacheable for short periods. **Image TTLs should be 30+ days**. Remember, they are referenced from source HTML, so if you update the HTML with a new name for the image, the image will update instantly.
 - ▶▶▶ If you have country-specific sites that sit on different
 - ▶▶▶ Hostnames—for example, uk.foo.cowm, de.foo.com, or www.foo.co.uk and www.foo.de—see if you can put all the objects on the same host. The company logo or the basic page structure may be the same for every site. It will drastically help with your cache-hit rate if you can share across different sites. Remember, the customer will not see the URL for the object; they will only see the base page.
- ▶▶▶ The more you can cache, the faster you can be. Bear in mind; there are three types of content:
 - ▶▶▶ Static – It never changes and is delivered to everyone the same. This content is highly cacheable.
 - ▶▶▶ Dynamic – It's generated, usually from a database, but it's delivered the same as Static content. For example, in a search for black trousers, more than one person can see a search for black trousers. Cache this content aggressively using query strings.
 - ▶▶▶ Personalized content – An example would be your bank statement, specific to you. This is content that cannot be cached since there is presumably only one viewer.

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- ▶▶▶ Set cache rules on the origin and have the CDN honor them. This way you remain in control of what is cached and for how long.
 - ▶▶▶ An added benefit of this strategy is that when you get too much load on the Web servers, crank up the TTL on your objects and watch the traffic drop for your origin server.
 - ▶▶▶ If you can use versioning in your URL structures (UNIX timestamp can be useful), you can max out your object TTLs and not worry about having to purge to change content.

 - ▶▶▶ Configure your origins for optimal hybrid CDN use:
 - ▶▶▶ Turn on GZIP – It will reduce your Data Center outgoing bandwidth, which means you always do the middle mile compressed.
 - ▶▶▶ Ensure you honor “If Modified Since” (IMS) requests at the origin; an IMS request is cheaper in bandwidth than a full GET.
 - ▶▶▶ CDNs love persistent connections (PCONN). Make sure you turn them on at the origin and pipeline your HTTP requests. Remember you have at least 2 TCP connections. Origin -> CDN Server and CDN Server to End User. A PCONN = more delivered in one round trip = less latency impact and larger round-trip payload.
 - ▶▶▶ Fully qualify your hostnames in source code. This will allow you to break up your content more easily if you want to domain shard, or if you want to deliver using different services (e.g., dynamic content via the dynamic service, static content by the cheaper static service).
 - ▶▶▶ Make sure your local load-balancers are not load balancing by client IP. Do it by session or some other layer 7 mechanisms. Remember, you will see an aggregation of TCP connections (as requests come via the CDN). If you have to use SSL, use an efficient certificate; for example, SAN or Wildcard Certs. It will save you cost and headaches in the long run.
 - ▶▶▶ Prepare your Intrusion Detection System (IDS) – Some CDNs can trigger them (including firewalls and other devices) due to pipelining.

Rule #2: Know your traffic.

What is your traffic type? Do you deliver masses of large files or video streams? What mechanisms will make it perform better? As discussed in the previous section, the type of traffic you have largely determines your caching capabilities. There are other factors as well. For instance, large file delivery is usually improved dramatically by increased throughput. So if that's your use case, then optimize for that by selecting CDNs that have great throughput in the markets you care about. Likewise, if HTTPS small objects are the majority of what you want optimized, it pays out to understand that and federate your networks to that end.



Focus on the Important Key Performance Indicators for Your Business

When considering business requirements, think granularly. Remember that in different countries, you will have different constraints and opportunities. You might even have different requirements, depending on the type of media or time of day. While your existing providers might have placed constraints on either cost or performance, put those limitations aside and determine what your business needs to succeed in each market.

Next, investigate what your users are actually experiencing. The results may surprise you. You need to know the range of your performance for every audience, in every context. Where are your success stories? Where are your failures? And, how do you measure them consistently? For example, a number of our clients are focusing on an emerging standard of “3 seconds or less to load any page.” Is this metric, or something like it, a useful one for your business?

Determine Your Business KPIs

GlobalDots considers the criteria that matter to you.

- ▶▶▶ Latency
- ▶▶▶ Availability
- ▶▶▶ Throughput
- ▶▶▶ Bursting fees
- ▶▶▶ APM data
- ▶▶▶ Geography
- ▶▶▶ User agent
- ▶▶▶ Green energy use
- ▶▶▶ Etc





Measure the Right Thing

If you are using only server-side experience measurement today, we suggest looking at actual user performance results, as well. Server-side metrics can tell you about load and latency on the servers, but they offer little insight into the actual customer experience. In order to make the best decisions about content delivery partners and platforms, you need to be armed with true visibility into your customers' experiences, around the globe. Only Real User Measurements (RUM) can take the guesswork out of how your site is performing in different locations across different networks.

This may seem like a lot of work, but the analysis is worth the effort. Cedexis has found that the companies that take the time to analyze the complete user experience of their customers have a greater success rate in choosing the best delivery partners. This allows the company to effectively optimize its mix of data center, CDN and cloud partners to achieve the best results. For example, a leading media company was able to boost overall response time 62% by leveraging a fine-tuned mix of delivery networks.

Finally, as you evaluate performance, be sure to define your success parameters. Are you focused on improving response time, increasing conversion, lowering bounce rates—or all three? Whatever your company's specific metrics are, determine them up front and then track them. By doing this, you will have data at the ready, to prove whether or not your platform partners are living up to their promise.

04. Choose the Best Delivery Partners for Your Business

Selecting the right set of delivery partners is a complex undertaking. It depends on the geo-location of your target audience, your performance needs, your price/performance goals, and the current capabilities of your cloud and delivery providers.

Start with the Customer

We suggest starting with the needs of your most important audience: your customers. What are the best delivery options for those customers to access your Web page, mobile application or the content they want to see? The best option for one customer, however, will not necessarily hold true for the next. And, it might change, depending on how they navigate through a site and access different types of content.

Thanks to the wealth of content delivery choices available today, companies are increasingly able to optimize their specific delivery price/performance strategy to suit their specific business objectives. For example, a company may want to focus on driving down costs in the Chinese market. Meanwhile, due to a new product launch, they want to maximize performance in India—all without compromising their application performance in the U.S.

Apply your business metrics from the start. Companies often spend a lot on a toptier cloud service, without the ability to evaluate the “performance effect” on their customers' experience.



Audit and Execute

Today, there are a variety of provider ecosystem options that offer ongoing insight into the price/performance reality.

For a functional and technology perspective, perform a functional audit of how your content distributors are working with you today. Where is the business logic located? What features are you using? Which of these are common to all of your partners and which are unique? There is a common misperception that each configuration is unique and switching costs can be insurmountable. While sometimes switching is complicated, if you follow the advice given in the previous section, you can escape vendor lock-in.

When taking inventory of your providers, pay particular attention to business logic you may have already pushed to the cloud. When working in a multi-vendor environment, it is critical to have consistency across the platforms. If you are using technologies that are specific to a provider, consider moving to industry-standard technologies that allow you to become vendor neutral.

As Always, Consider ROI

It is also important to ensure that the ROI you are gaining from using each provider is worth the cost of the services. And don't forget the cost of supporting them. Be sure to consider moving business logic back to your own architecture should you need to, as there can be significant benefits to doing this. Remember, your delivery partners should ideally be doing the heavy lifting for you. Your application architecture should focus on the higher value transactions; effectively, your service providers are the muscle and your architecture the brain.

Load Balancing

Finally, if you are moving to a Multi-CDN environment, make sure you have a system to load balance effectively between providers. As a business, the objectives for utilizing this type of architecture are likely a blend of several factors. Cost, performance and availability could all be metrics you will want to be able to evaluate when choosing how an end user should be served. To make the most of your investment, ensure you have a system that allows you to make automated, real-time decisions on how a customer should be served—with the objectives of the business in mind.

For GlobalDots clients, this is achieved through the integration of a highly programmable global-load balancer. Customers use this load balancer to combine cost, location and real-time CDN measurements to automatically balance loads for optimal performance.



05. Mitigate Risk as You Roll Out

Once you have selected the best providers for your specific delivery needs, you will need to configure and program them to work together. Ensure you mitigate the risks of deployment. Up-to-the-minute, actual user monitoring data plays an integral role here.

Don't Isolate the Deployment Team

Make sure you and the surrounding business units understand the broader impact of working with a particular content platform. Look at the entire corporate architecture, not just your business unit's Web operations. Many organizations have business units that operate at different layers of the application architecture. Be sure to review the plan with all teams that could be affected by your choice of architecture, including customer care, content editors, and your application development teams.

Look for the quick fixes that have become established practices within these groups. These can lead to unpleasant surprises. For example, one group might be maintaining a tremendously large file for some reason, but it can impact the integration and flexibility of your new platform. Perhaps it is time they found a better way.

Recommendations:

- ▶▶▶ Prepare your QA and development environments to include CDN vs. Non-CDN testing and inform your developers. This way they are not surprised when they do an update and see that something hasn't changed.
- ▶▶▶ Have a suitable publishing methodology (e.g., unique URLs, purging, time delay) and make sure everyone knows about it.
- ▶▶▶ Ensure you have an understanding with the marketing or creative department on how long their updates will take. There is no reason why all their requirements can't be met.

Use Your Existing Benchmarks and Track throughout the Rollout

Based on the ecosystem audit you completed as preparation, initiate testing early and continue it as you roll out the new service. Many systems during an integration phase need to be tweaked and retested. Monitoring this period can provide valuable information you can act on quickly. Also, remember to base some of your tracking on a consistent single object that you will transition to your new environment.

Unlike pages, which often change during integration, tracking an object will give you a more qualitative metric for before and after comparison. Review Your Test Environment Moving to the cloud means your test environments will need to be adapted. Ensure you spend time setting these up before you start integrating the new environments.



Be Methodical as You Bring New Providers Online (or Remove Providers)

When bringing a new provider online, do it gradually. This will give you time to evaluate the new architecture, as well as to ensure you do not impact your existing delivery system. For example, there may be cases in which your new content provider may not already have the content on its servers. This can cause unnaturally high request rates from their servers as they first begin to populate with content.

This same caution needs to be applied to removing providers. Sometimes providers become redundant geographically. Other times, costs can dictate that a provider needs to be removed. Either way, the same rules apply.

Many companies program their load balancers to gradually ramp up a subset of their traffic toward the new provider, while actively measuring load, response times and performance, using end-user monitoring tools. An intelligent load balancer configuration will not send the new provider more traffic than it can handle, and, should it slow down, will route customers back to the original platform, ensuring minimal end-user impact.

GlobalDots has guided many clients through the addition of new providers. Users of our global server load balancing service typically begin by pushing 5% of their traffic to the new provider at first, increasing to 10% and so on. We also recommend implementing an automated user-feedback mechanism so that if end users are affected by the change, you can automatically roll back to the original architecture while the issue is being resolved.



Strategies for Bringing on a New Provider

- Reduce your DNS Time To Live (TTL) on the site for a week beforehand. Five minutes should really be the maximum TTL. If you have a DNS TTL of 30 days do not be surprised if it doesn't propagate for that period of time.
 - After a week, change the DNS entry/CNAME to GlobalDots/CDN.
 - Keep the DNS TTL short, around 1 day.
 - Complete your testing and integration work.
 - Once happy, then lengthen your DNS TTL, (or have Cedexis in the resolution chain). This way, you can always roll back quickly. A slightly larger DNS bill is better than having no shop online during Friday at lunchtime.

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- ▶▶▶ Take the lowest risk integration first; cache nothing.
 - ▶▶▶ Use opt-in caching by configuring on the origin. Remember, your Web server logs will be a good indicator of how well you are doing; they should shrink.
 - ▶▶▶ If you use logs for reporting, make sure you set them up with the CDN to be delivered. Be aware you might not get them as quickly as you get them from your own Web server. If this is a problem for your site, you may need to look at using CDN APIs to get closer to real-time reporting.
 - ▶▶▶ Always have a production and a pre-production version of the config on the CDN. Also make sure people know which one is which.
 - ▶▶▶ Clever Authentication schemes on your pre-production site usually cause testing hell, as the CDN can't get access to a secured back-end. If you need to do this try using a single server of the CDNs by spoofing your host file and then matching requests up to your origin. For example, look in the server logs for the IP and the request you made. A good way to do this is to attach a query string with some text you can search for. You can then add this IP into your ACLs on your firewall. Note this is a hack and works, depending on which CDN you use. Alternatively use the CDN's staging network, if they have one.

06. Tips For Good CDN Relations

If you have a fantastic cache hit rate and you have really small origin architecture, don't purge everything all at once. A CDN can take the origin down as it revalidates/obtains the content again. The CDN essentially DDOSs your origin with requests.

To ensure that over-purging does not take your origin down, make sure that your CDN includes a mid-tier or origin shield to prevent accidental self-inflicted DDoS.

When debugging, start from the origin and work back to the CDN. Most CDNs are great at doing exactly what you tell them. The chances are it's probably something you configured on the origin that caused the CDN behavior to occur.

Check each server instance if you are getting intermittent behavior on a CDN. Cluster synchronization is a good gotcha and should be tested from the outside in. Just testing on the box doesn't necessarily help; follow the same path that a request would. If you have a problem with some content, provide the CDN's customer care department, if you can, with the following information.

It will really help them:

- The URL you are looking at (not just a screen dump).
- Your public IP address.
- The server you are talking to (do a dig or nslookup).
- If you are using a private VPN or are on a network with a proxy, tell them that it may be the proxy in your office is having a moment.

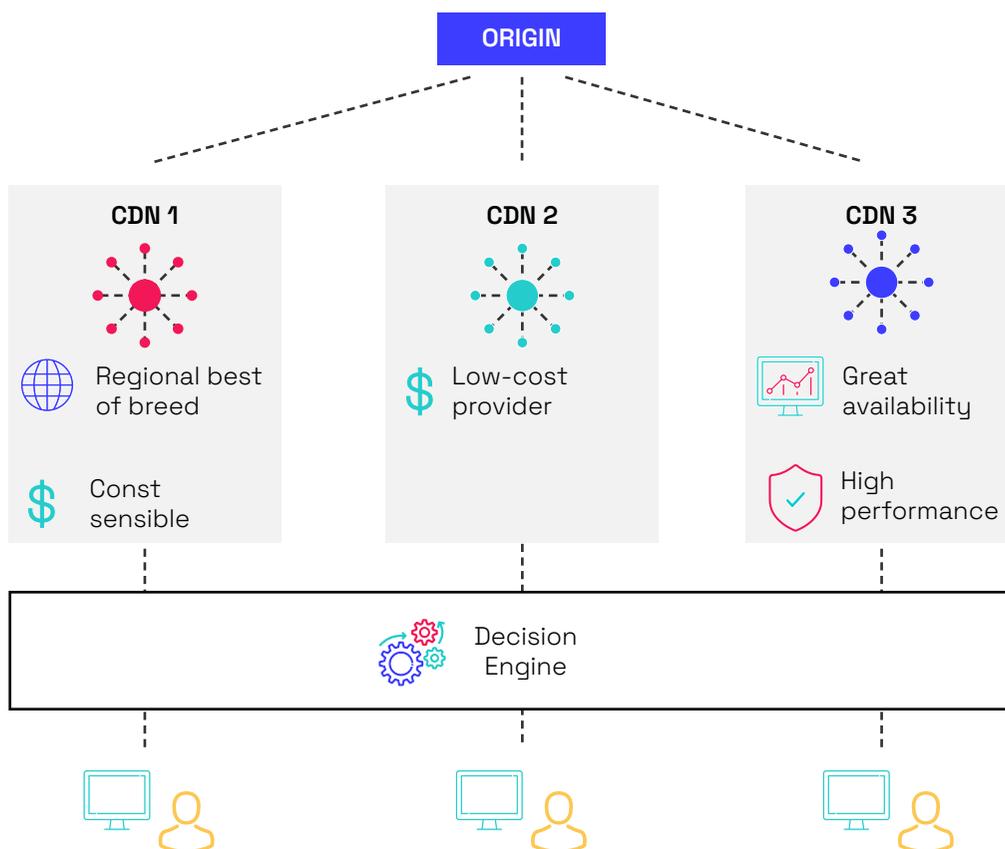


Figure 5: Customers are becoming more demanding. The internet is becoming more complex, and delivery platforms are becoming increasingly specialized.

Conclusion

Performance optimization is an ongoing exercise. Customers are becoming more demanding, the Internet is becoming more complex, and delivery platforms are becoming increasingly specialized. Moving to a hybrid model is not a one-time project, but a new way for you and your website to operate.

If you are evaluating the performance benefits of an intelligent load-balancing solution, and monitoring how end users are being affected by your architectural strategy, GlobalDots can help.

Our global server load-balancing solution gives you the ability to precisely control the balance between performance and costs for every web transaction.

We also have a real-user monitoring solution for real-time performance optimization. This platform has taken over 200 billion measurements and there is no more comprehensive resource for measuring cloud, CDN and datacenter performance.

Thank you for reading!

We hope you found useful information in this guide and that it will help you gain better insights and knowledge about CDN. We can advise and present you with the best possible CDN solution for your business – regardless of your company size and vertical.

Feel free to contact us at sales@globaldots.com

About GlobalDots

GlobalDots is a world leader in implementing B2B cloud & web innovation. With 17 years of CDN & Web Performance experience, spanning over countless verticals & use cases, we break the boundaries of off-the-shelf products and vanilla configurations to create the optimal stack for your business. As a lifelong partner of world-leading CDN providers such as Akamai, Cloudflare and Amazon Cloudfront, we are the world's #1 enabler of Multi-CDN strategies and CDN migration.

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