



How does your CDN strategy impact the Quality of Experience?

You cannot improve what you cannot measure. Learn about our first comparative look at the content delivery network (CDN) performance metrics of major CDN providers in Spain.

A CDN is a network of Points of Presence (PoPs) or servers to make content distribution reliable and effective. There are many CDNs in the market, such as Akamai, Fastly, Amazon CloudFront, Google Cloud and Cloudflare.

As an Internet service provider (ISP) or over-the-top (OTT) provider, you would like to understand what a collaboration with these providers means for you and for your customers and, in more general terms, what the benefits are of caching, interconnection, routing and peering agreements. Telecommunication operators and other entities usually want to go beyond the typical list of points of presence (PoPs), services and pricing.

As a CDN provider, you would like to understand how the optimizations you are making to the networks and new products and solutions improve performance and stability for your clients and end users.

ISPs and CDN providers alike want to understand how they compare against competitors to discover what is average and what is best-in-class network performance.

It can be very difficult for CDN providers, ISPs, telecommunication operators and other entities to anticipate cloud performance and understand its impact on daily operations and services. Organizations want to improve the experience for end customers but cannot improve what they cannot measure.

About MedUX

MedUX is the leading company in customer experience measurement in fixed, mobile and TV telecommunications networks, providing cutting-edge tools and innovative solutions for telecom operators, governments and companies. MedUX has a hybrid Technology, Software and Information as a Service model and now serves top Telecom Operators such as America Movil, Vodafone, Millicom and AT&T, in over 15 countries.

Our solutions enable our customers to stand out from their competitors, have real-time visibility into the true customer experience and in-home performance, reduce costs and the time to insight and enhance their value propositions, thereby increasing customer satisfaction, anticipating their problems and avoiding complaints.

Improving Customer Experience in the 5G era!

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Network benchmarking and network monitoring applied to CDN services help organizations to understand how key metrics and actions improve network performance and end customers' Quality of Experience (QoE) based on the presence of the CDN. Our solutions offer organizations the ability to:

- Benchmark CDN performance across CDN providers and ISPs. Performance statistics help identify competitive gaps, performance patterns and potential areas for optimization.
- Monitor and optimize CDN performance and other QoE-related indicators from customer premises. Diagnose and better manage service incidents, quickly detect performance issues and lower the mean time to resolution (MTTR), in addition to having full visibility on pre- and post-optimization improvement actions.
- Control SLAs with CDN vendors. Independent validation and measurement can be used to ensure that CDN vendors are offering a good service.

To offer these capabilities, MedUX is launching its new CDN performance test that measures, monitors and benchmarks the performance of several CDNs directly from customer premises, revealing the TRUE customer experience.

The test initially measures throughput and latency to CDNs by fetching an object over TCP/IP. Current default test configuration, during the first trials with European telecommunication operators, is set up to fetch a 10 MB file.

According to our trial measurements, Akamai is the fastest CDN provider in Spain, followed closely by Fastly in both throughput and latency. Amazon Cloudfront, Google Cloud and Microsoft Azure lag clearly behind in throughput, and Amazon Cloudfront and Cloudflare lag in latency.

MedUX provides objective and independent CDN performance benchmarking and monitoring metrics to gather competitive intelligence information and to help our clients understand what to expect when adopting cloud services. Our benchmarking covers not only the average performance of each CDN provider but also a more granular view of the performance depending on location, the telecommunications operator and the speed profiles and technology of the end customer.

Read our full paper to learn:

- The “what” and “why” of CDNs
- What our CDN performance test measures
- How CDN providers perform in Spain



How do CDN providers perform in Spain?

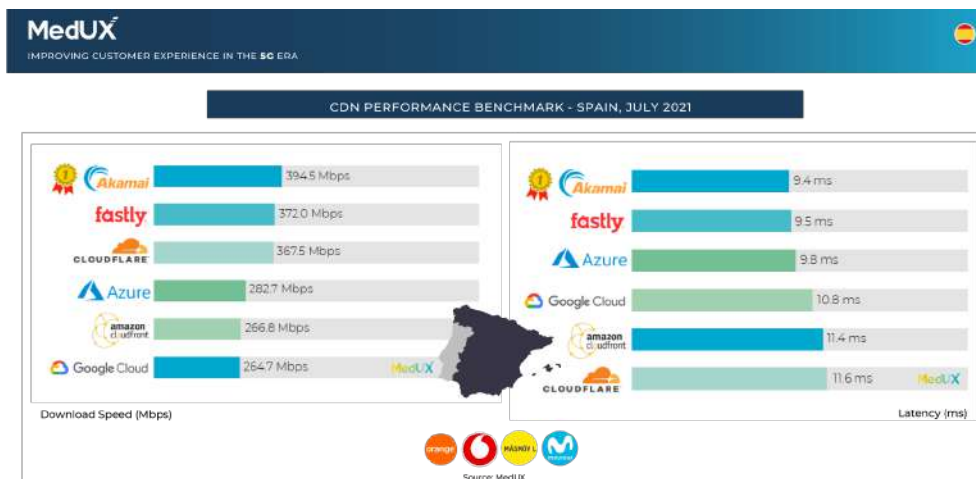
We have conducted CDN performance benchmarking trials with some of our clients across Europe to help them determine whether and how to collaborate with certain CDN providers to lead to a meaningful improvement in end-user experience.

MedUX has thousands of devices on customer premises all over Europe and is willing to deploy more to meet clients' specific needs. Leveraging MedUX's footprint across major ISPs in major cities, you can identify gaps and potential issues or even understand peering policies when requests from different ISPs from the same geographical area perform differently.

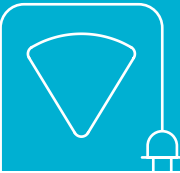
MedUX has performed a trial measurement of and first comparative look at performance metrics of major CDN providers in Spain from an end-user perspective while examining Spanish broadband ISPs' performance, with more than 20 thousand tests and hundreds of thousands of statistics and measurement data points collected during June and July 2021.

Akamai is the fastest CDN provider in Spain, closely followed by Fastly both in speed and latency. Amazon Cloudfront, Google Cloud and Microsoft Azure lag clearly behind in throughput, and Amazon Cloudfront and Cloudflare lag in latency.

Figure 1: CDN performance by speed and latency



To perform this trial and high-level analysis, we selected a representative sample of MedUX HOME Devices hosted on residential customer premises with real end customers. All measurements and statistics collected are based on fixed broadband connections over FTTH lines.



The information collected, courtesy of one of the leading operators in Spain who owns this proprietary benchmark, corresponds to June and July 2020. The probes are evenly distributed in major cities, such as Madrid, Barcelona, Sevilla and Valencia, and across major ISPs in Spain, such as Telefonica, Vodafone, Orange and MásMóvil, with 600 Mbps and 1 Gbps speed profiles.

In this study, we measured the performance of the aforementioned major telecommunication operators and the following CDN providers, but many more beyond the scope of this trial are available on demand:

- Google Cloud CDN
- Amazon Cloudfront
- Microsoft Azure CDN
- Cloudflare
- Akamai CDN
- Fastly CDN

Our benchmarking usually covers not only the average performance of each CDN provider but also a more granular view of performance depending on location, the telecommunications operator and the speed profiles and/or access technology of the end customer.

The figures below compare the median download (DL) throughput and the DL throughput statistical distribution for major CDN providers as well as the median latency or Round-Trip-Time (RTT) and its statistical distribution.

Akamai shows a notably higher DL throughput based on our proprietary multi-thread download speed test (see further details below about our MedUX Cloud Speed Test) and a lower latency. This is to be expected from the biggest CDN provider, as it seems to have better agreements with telecommunication operators in Spain, even including the deployment of Akamai caches inside the ISPs' networks.



Figure 3: Download throughput of the main CDN providers



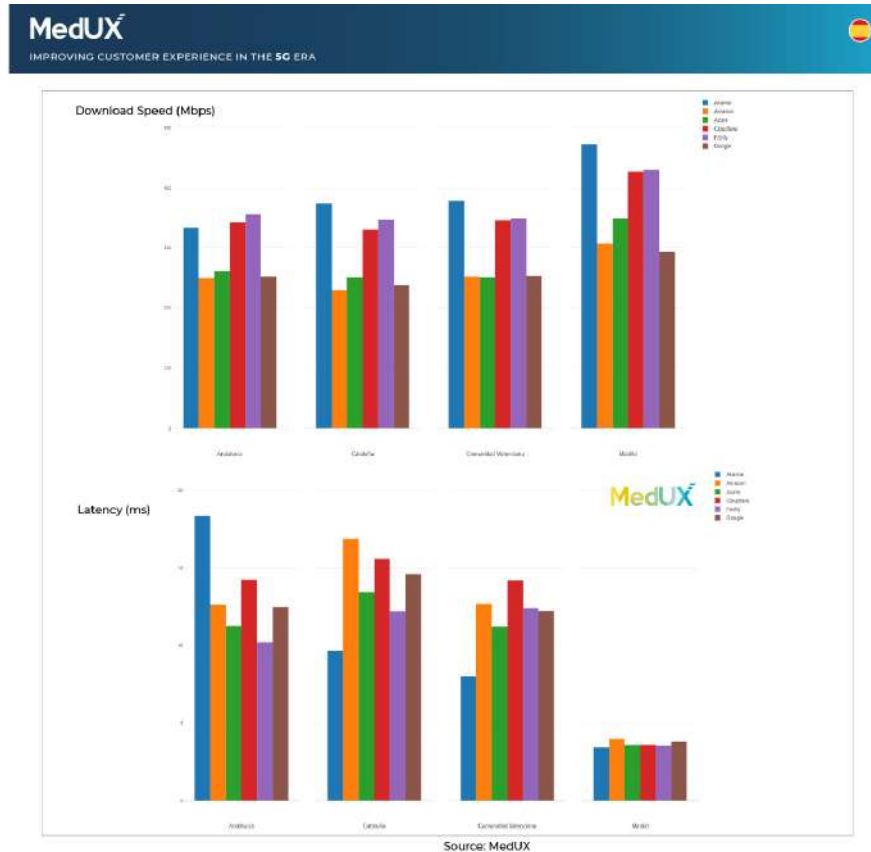
ISP and CDN provider connectivity approaches vary significantly, leading to geographical differences in network performance and stability.

While Akamai, Fastly and Cloudflare exhibited a robust throughput above 300 Mbps across main regions and cities in Spain, regional differences can be observed. Madrid shows higher speeds for all CDN providers, generally 20–40% higher than those in Catalonia, Valencia, and Andalusia.

In terms of latency, average values in Madrid range from 3.4 to 4.0 ms depending on the CDN provider, much lower than the rest of the regions, which exhibit values between 8.0 and 18.3 ms depending on the provider and the region. For example, in Catalonia, Valencia and Andalusia, Akamai exhibits 2x–6x the network latency than it does in Madrid.



Figure 4: CDN Download speed and latency by region



The results and summary presented above are based on data recently gathered, mostly in June 2021. Entities relying on the cloud and Internet performance should continuously monitor this KPIs for changes and optimizations by the ISPs and CDN providers. For example, it will be interesting to understand how Amazon’s \$3 billion investment in opening data centres in Spain will improve the aforementioned results and how it will contribute to the overall digital transformation and connectivity ecosystem in Spain.

The “What” and “Why” of CDNs

A CDN is a network of Points of Presence (PoPs) or servers to make content distribution reliable and effective. CDNs are widely used by ISPs, content providers and websites to distribute static assets as close to the end users as possible. These static assets, which have content that does not change, include images, JavaScript, software packages and audio and video libraries (e.g., Video on Demand (VoD)). As these static assets grow in number and size, bandwidth usage and website loading times increase, causing the web browsing



experience to deteriorate.

CDN providers run an edge cloud between data centres and end users by placing caches inside ISP networks so that traffic does not even need to leave the ISP network. Basically, webpages render faster, video buffering time is reduced, users stay more engaged and content providers get more business.

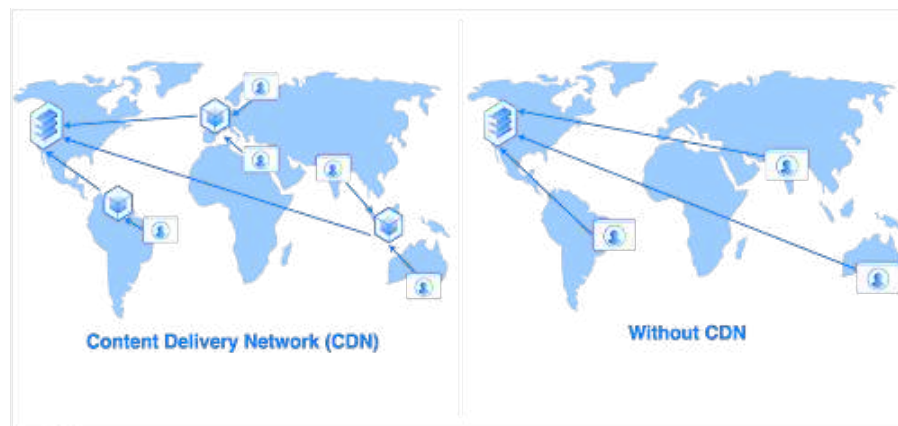
Using a CDN has several advantages:

- Improved load time (performance): Asset and application loading time and experience improve because content is delivered from a CDN server nearest the end customer's location, which brings down latency.
- Reduced bandwidth (costs): CDNs introduce caching and image optimization services, which can help reduce bandwidth consumption costs.
- Enhanced availability: Content remains more accessible to end users, and distributed networks can serve more requests under high-stress situations, such as excessive user traffic, intermittent spikes and potential server outages.
- Upgraded security: CDNs can provide DDoS (Distributed Denial of Service) mitigation and other critical security optimizations.

Using a CDN offloads content loading from origin servers, reduces the burden on the content providers' servers (spreading the burden to a wider array of servers), reduces the volume of traffic in certain parts of the ISP's network (less load on transit and peering links), reduces latency and improves web loading times, live streaming, gaming and on-demand delivery of videos or downloads.

Figure 5 offers a high-level overview of how geographically spread-out CDN PoPs help fetch content from servers closer to the end customer (images courtesy of [Digital Ocean Using a CDN to Speed Up Static Content Delivery | DigitalOcean](#)).

Figure 5: Data transmission without and with a CDN (Source: Digital Ocean)



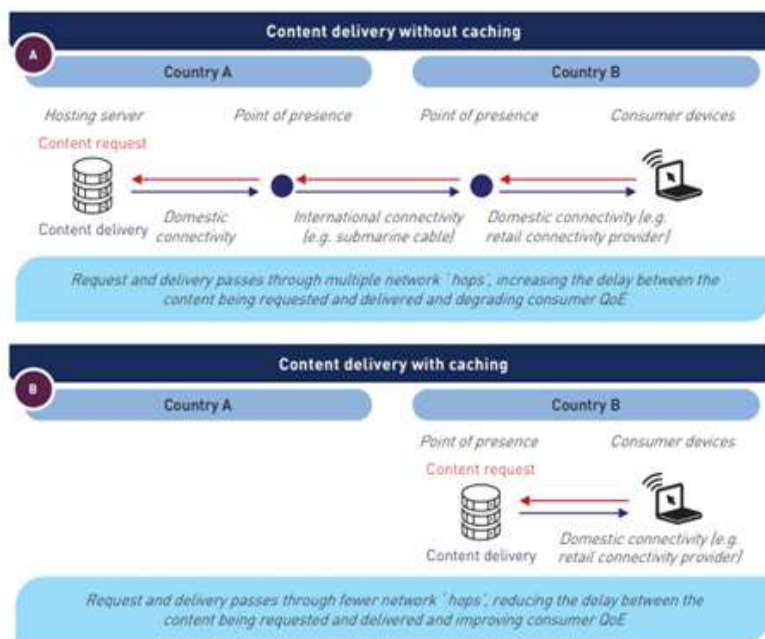
Source: Digital Ocean



When a user downloads a file while web browsing or streaming, the CDN routes their static asset requests to the nearest edge server (if the content receives a moderate amount of traffic) from which the content is served. If the edge server does not have the assets cached or the cached assets have expired, the CDN will fetch and cache the latest version from either another nearby CDN edge server or the origin servers.

In its report ‘Benefits of Caching’, Analysys Mason highlights the importance of a proper CDN and caching strategy to improve the Quality of Experience and availability/reliability, in addition to other benefits, such as increased network efficiency and more dynamic competition (including faster innovation).

Figure 6: Impact of caching (Source: Analysys Mason)



As Analysys Mason states in ‘IP Interconnection on the Internet: A White Paper’, ‘The network developments of CDNs diminished the case for paid peering, as content could be delivered at the same Internet Exchange Point (IXP) as it was requested, thus lowering the carriage cost for the receiving ISP. Today several content providers are making significant investments in network infrastructure to deliver content closer to end users. This involves installing caches and PoPs, and even building subsea cables between continents and countries, to deliver content to PoPs and caches. Increasingly, CDNs are putting equipment into ISP networks (also known as ‘on-net’), to deliver the traffic directly.’



What does the MedUX CDN performance test measure?

Our newly developed test measures, monitors and benchmarks the performance of several CDNs directly from customer premises revealing the TRUE customer experience. Our new CDN performance test, soon available to all our clients, collects several metrics on content delivery that are key to the overall customer experience: availability, responsiveness and throughput when downloading content cached in different major providers.

We provide objective and independent CDN performance benchmarking metrics to gather competitive intelligence and to help ISPs and OTT providers understand what to expect when adopting cloud services. Our benchmarking covers not only the average performance of each CDN provider but also a more granular view of performance depending on location, the telecommunications operator and the speed profiles and technology of the end customer.

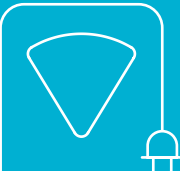
The MedUX CDN performance test initially measures throughput and latency to CDNs by fetching an object over TCP/IP. Similar files are fetched from each CDN to provide comparability across the panel. The test can be configured to fetch a small object, small files, large files or any type of content.

The metrics collected by the test are as follows:

- Download transfer rate or speed (not necessarily representative of maximum line speed)
- Latency
- The IP address of the CDN node

The current default test configuration is set up to fetch a comparable 10 MB file. Standard metrics can be complemented by other tests, such as CDN availability, network path to CDN nodes, HTTP DL (object fetching) and DNS requests.

The measurement of the download transfer rate or speed is based on the unique testing methodology used in the MedUX Cloud speed test. The DL Cloud speed test results in an actual sustained download speed defined as throughput, in Mbps, utilizing as many concurrent TCP connections as dynamically required and measured at a typically 20–25 second interval of a sustained data transfer.



The Cloud speed test establishes multiple simultaneous connections when running, allowing us to fill the available bandwidth more easily. As the test progresses, more threads are dynamically opened by the client device, if required to measure the maximum download speed more accurately. Therefore, the client device receives content via different threads established through the communication channel and the network. The test ends once the configured amount of time has elapsed.

The United States Patent and Trademark Office (USPTO) recently issued MedUX US patent number 10,931,553 for 'evaluating network speed by multiple parallel data exchanges between a client device and multiple servers via the network'.

CDN providers currently supported for testing are as follows:

- Google Cloud CDN
- Amazon Cloudfront
- Microsoft Azure CDN
- Cloudflare
- Akamai CDN
- Fastly CDN

MedUX HOME deployments and SMART PERFORMANCE services

We are available to discuss engagements related to network performance benchmarking, network monitoring and CDN provider selection support. Benchmarking may cover public and private benchmarking engagements; the latter will be kept confidential for strategic purposes and decisions.

If you are interested in our solutions and how we might assist you, please do not hesitate to contact us at hello@medux.com.

DISCLAIMER - The purpose of this paper is to highlight the importance and differences of CDN performance and end-user experience by CDN provider through a statistically relevant trial measurement. It is not meant to endorse any brand over another but purely a result of MedUX measurements. None of the parties evaluated, paid for any component of the paper nor participated in any form during the preparation of the results. Using or citing these findings for marketing or other purposes without the knowledge and express authorization of MedUX is strictly prohibited.

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