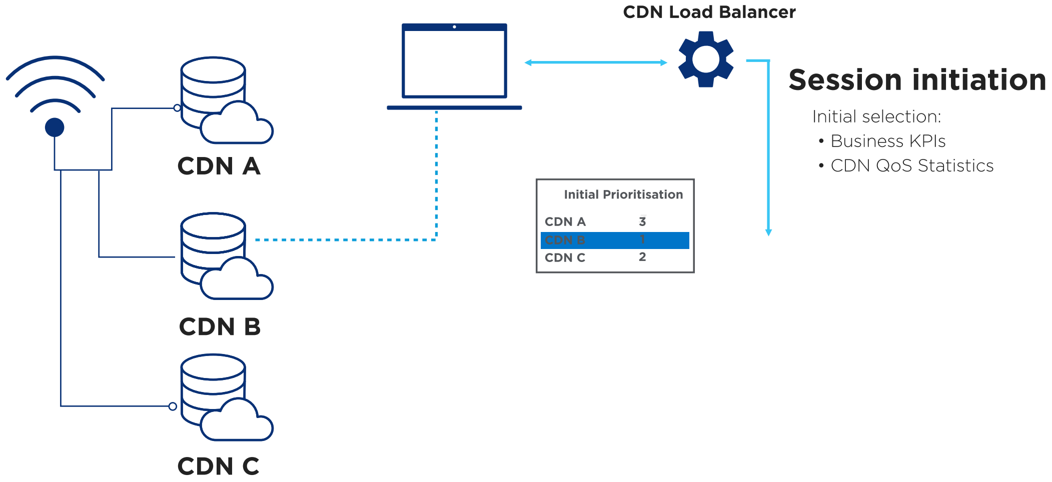
Lumen® CDN Load Balancer

Technical data sheet

Lumen® CDN Load Balancer is a dynamic in-stream CDN selector that facilitates traffic management while customizing video delivery to each viewer. Our solution uses real-time feedback from the device to choose the optimal CDN on a segment-by-segment basis during the individual video session.

How it works

1. Session initiation & initial scoring



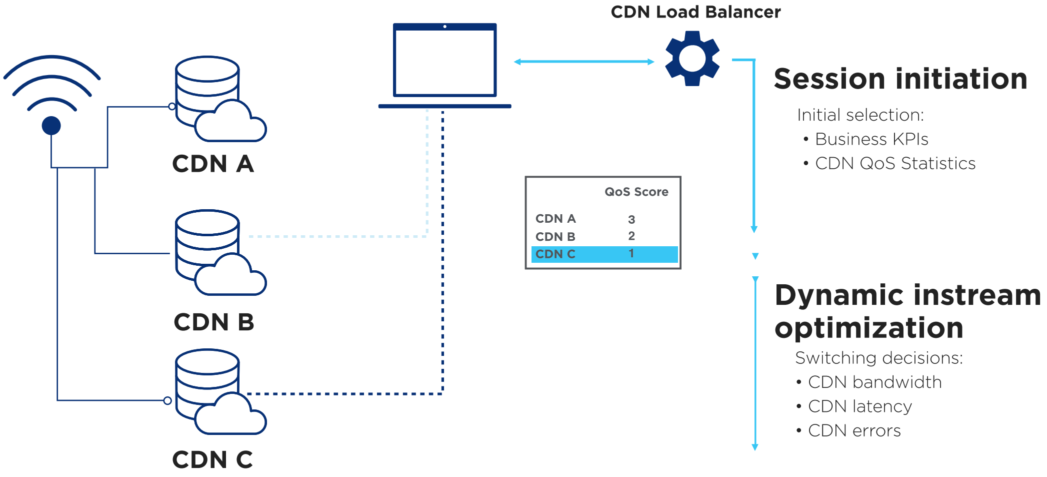
	Initial Prioritisation
CDN A	3
CDN B	1
CDN C	2

Session initiation

Initial selection:
- Business KPIs
- CDN QoS Statistics

At the video session start, CDN Load Balancer selects the most appropriate CDN from the business inputs of your choice, as well as from the QoS statistics we have gathered from other devices in your user base.

2. Midstream Optimization



	QoS Score
CDN A	3
CDN B	2
CDN C	1

Session initiation

Initial selection:
- Business KPIs
- CDN QoS Statistics

Dynamic instream optimization

Switching decisions:
- CDN bandwidth
- CDN latency
- CDN errors

For each segment request during the video session, the current CDN bandwidth, latency, and errors are calculated to assess whether or not a change should be made to improve quality or avoid congestion or failure. The next video segment is automatically redirected to the corresponding CDN.

How does CDN Load Balancer calculate CDN scores?

Calculating the Global CDN score

CDN Load Balancer bases its selection and switching decisions on a "global" score. In practice,

Global score = business score * QoS score

The global score is based on:

1. **A business score** provided by the broadcaster: this business score reflects how heavily commit- or business-based inputs should be evaluated; it can take integer values of 1 to 100.
2. **A quality of service score**: at the beginning of the session, the QoS score is calculated from the metrics CDN Load Balancer gathers from across the broadcaster's user base. During the session, the QoS score is the quality perceived by the end-user device during the session: bandwidth, time to first byte, and error rate.

After the beginning of the session, quality is calculated locally. This prevents CDN Load Balancer from becoming a single point of failure; during the session, CDN Load Balancer only connects to the backend to send quality statistics to be used in initial scoring for future sessions.

Practical example

A broadcaster uses three CDNs for delivery on the West Coast of the US. CDN A is its primary delivery network with CDN B and CDN C as backups. It assigns each CDN the following business scores:

CDN A: 8 CDN B: 4 CDN C: 2

In this case, CDN A will be chosen except when CDN B's quality of service is more than twice as high as that provided by CDN A. In practice, this means significantly lower bandwidth or prevalent errors. By the same token, CDN C will not be used unless its QoS is more than twice as high as CDN B, and CDN A is not available.

The technology behind CDN Load Balancer

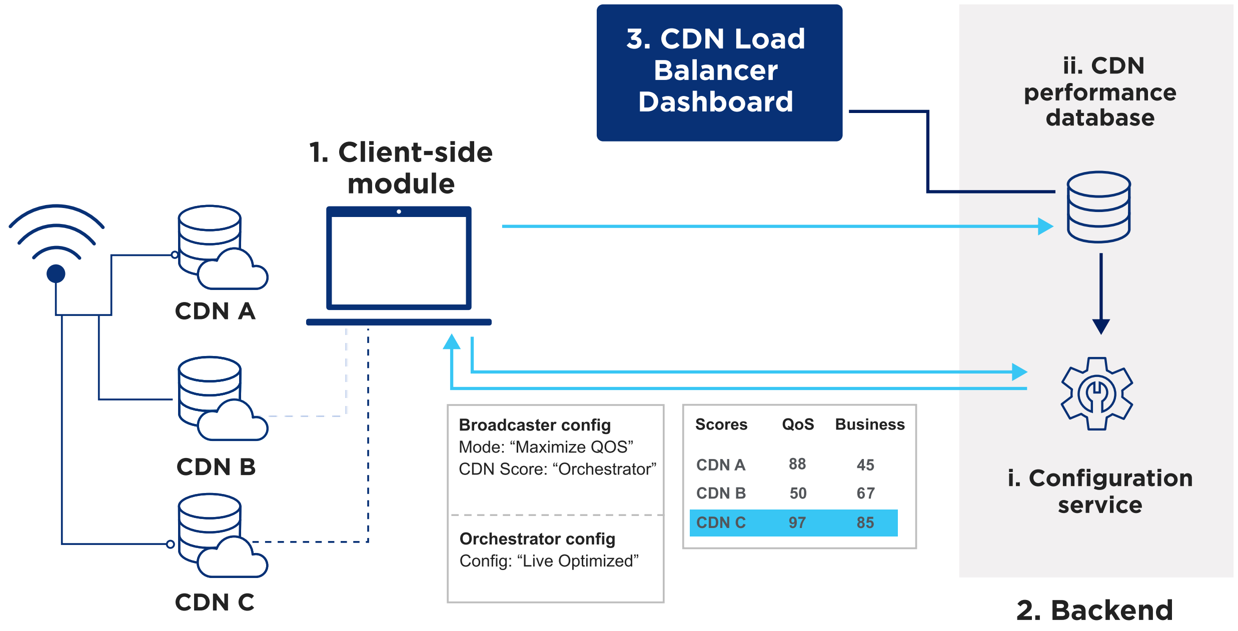
As shown in the following diagram, CDN Load Balancer is composed of (1) a client-side module that integrates into the video player; (2) a backend to initiate and control configuration of the client, deliver QoS & business scores, and store quality metrics for each CDN; and (3) a dashboard for customer configuration, activation, and monitoring.

Upon starting the video, the end user fetches the first video segments from the default CDN, i.e. the CDN towards which the manifest URL is pointing.

At the same time, the client-side module connects to the configuration service (i) that authenticates the viewer and returns a specific configuration. This configuration has been set in part by the broadcaster, and in part by CDN Load Balancer to optimize the behavior of the decision algorithm in accordance with the broadcaster's use case.

The service also returns the business score and quality of service information available from each CDN. These allow the client-side module to understand the current state of each CDN in the end user's situation.

During the session, the client-side module independently calculates the global CDN score, taking QoS measurements at each segment download and merging them with the historized and aggregated data that it has received. This information is sent to the CDN performance database (ii) which is in turn displayed in the CDN Load Balancer dashboard.



Broadcaster config
Mode: "Maximize QOS"
CDN Score: "Orchestrator"

Orchestrator config
Config: "Live Optimized"

Scores	QoS	Business
CDN A	88	45
CDN B	50	67
CDN C	97	85

This feedback loop continues throughout the video session. On a segment-by-segment basis, CDN Load Balancer routes the delivery of the video data to the CDN that offers the best QoS while complying with the broadcaster's routing rules. This is done by rewriting the HTTP request URLs.

CDN Load Balancer may choose to source a segment from another CDN every so often to keep up-to-date QoS measurements on CDNs that are not actively being used. This occurs only if the player's video buffer is full and the download does not induce a risk of rebuffering. In doing so, CDN Load Balancer can make routing decisions with fresh localized data.

How CDN Load Balancer stands out

Seamless midstream switching

By dynamically choosing CDNs on a per-segment basis, CDN Load Balancer can seamlessly switch during the video session without a page refresh and without adding a single point of failure to your workflow.

Protection for your entire workflow

By switching CDNs during the session without the user having to refresh the page, CDN Load Balancer protects against the cascade effect that a CDN failure and a massive number of refreshes can have on other parts of your video workflow.

Business rules & third-party API support

Use the business policies you have in place internally or via a third party. Once CDN Load Balancer has reliable user-specific data, it merges the device's local data with the global CDN rankings received for holistic decision-making.

Independent QoS optimization

Lumen® CDN Load Balancer makes switching decisions client side, based on feedback from segment downloads. It does not require persistent connections to a backend and therefore does not create a single point of failure.

Specifications

Platforms	**Web**: All browsers (Chrome, Firefox, Safari, Opera, Chromium-based browsers, Edge, IE), Chromium-based STBs, Chromecast. **Mobile**: Android, iOS **Set-top boxes**: TVOS; C++ code base easily portable to custom set-top boxes
Players	hls.js, dash.js, video.js, Shaka Player, Flowplayer, Clappr, JW Player, THEOPlayer, Bitmovin Player, RadiantMP, castLabs, Brightcove Player, Azure Media Player, thePlatform MPX Player, Rx-Player, Akamai AMP, Kaltura Player, NexPlayer, Arkena Panda Player; custom HTML5 players upon request.
Media format	HTTP streaming support: DASH, HLS, CMAF; multi-bitrate live and VoD streams
Media features	Content protection: DRM, tokens, geo-blocking & authentication mechanisms SSAI, client-side ad insertion, subtitles, multi-audio, DVR
Security features	Domain whitelisting; app secret key whitelisting; geoblocking per country or per ASN Fully encrypted communications with the backend (HTTPS & WSS).
Uptime	Multi-region backend; seamless fallback to the default CDN for new video sessions in case of an issue; client-side decisioning requires no backend connections during the video session.
Client switching optimization	100% transparent for end-users: no plugins or extensions to install. In-segment multi-sourcing: fetching each segment from the optimal CDN for each viewer. Configurable segment sourcing from non-chosen CDNs when video buffer is full to keep up-to-date QOS data on each CDN. Configuration injection: per customer, per platform, per stream tailored to each use case.
Data	GUI and data API for CDN traffic, CDN bandwidth (as measured by viewer devices), CDN error rates, concurrent viewers and buffering ratio, all over time.

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