

BROCHURE

Lumen[®] Mesh Delivery

For global game & software downloads



Summary

As internet traffic from software updates and game downloads continues to grow, it is increasingly difficult for publishers to reach their audiences effectively across the globe. The new, more immersive formats of the metaverse will only raise the stakes.

Software and game updates produce record CDN traffic, generating unprecedented loads on global networks. In some areas, internet regulators have gone as far as to intervene to keep large releases from clogging peering points between ISPs and disrupting other internet traffic.

Today, flexible, reliable scale is critical.

Lumen Mesh Delivery takes a hybrid approach to game updates, software and large object delivery combining a hybrid peer-to-peer technology with traditional CDN.

Working in tandem with your existing CDN infrastructure, our peer-to-peer technology dynamically retrieves portions of the file from the source that can provide them most quickly.

During major releases and high-volume updates, more devices mean a more powerful network, thereby mitigating the congestion that could negatively impact download time and completion.



Benefits

Performance and scale

Enjoy up to 10 times¹ the capacity instantly, with a solution that scales naturally to any audience in any region of the world.

Configurable

Deploy the solution either across your platform or locally with custom ISP and geo access parameters. Configure your delivery per device, ISP and geography.

Network aware

ISP-friendly technology considers network topology and peering arrangements to route traffic effectively. With our intra-ISP matching algorithms, up to 90% of peer-to-peer traffic² can stay within ISPs' internal networks.

User-friendly

In addition to download time improvements, Mesh Delivery analyses CPU, RAM and bandwidth available to users to adapt delivery to the device.

Secure

A centralized backend controls access and authentication to the file; hash checks are performed on all data exchanged via peer-to-peer.

Integrated directly into your downloader

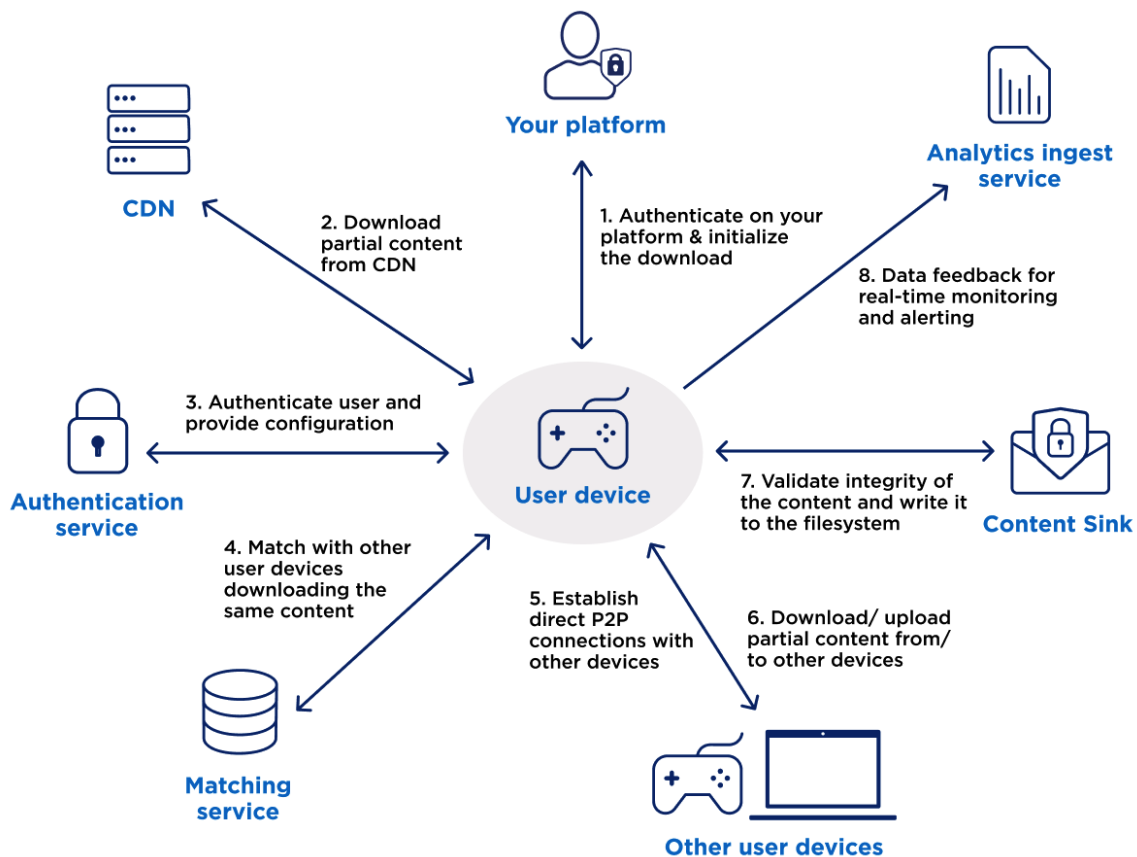
Our lightweight module is designed to have minimal impact on your current stack and offer you full control of your code. The technology is configurable directly from your downloader or our dashboard.

¹ Based on -90% maximum CDN offload for Mesh Streaming achieved in production in February 2022 (Capacity with P2P = Capacity CDN / (1 - CDN offload))

² Based on live streams delivered by Mesh Delivery during the 2021 French Open

Technology

1. Your download application initiates the download of a file & authenticates the user on your platform.
2. The client device starts downloading pieces of the content from the CDN.
3. The device simultaneously authenticates on our backend and is given a specific configuration to optimize download speed.
4. The client device requests peers periodically throughout the session from our matching service.
5. The matching services enables peers to open direct P2P connections.
6. During the session, the device alternates between P2P and CDN delivery with the goal of optimizing the median & average download speed, as well as CDN offload.
7. The device confirms that each piece of content downloaded from the peer network is the right one via secure hashes. Verified content is written on user file system.
8. Each device periodically sends analytics to our data pipeline, which provides real-time monitoring and analytics.



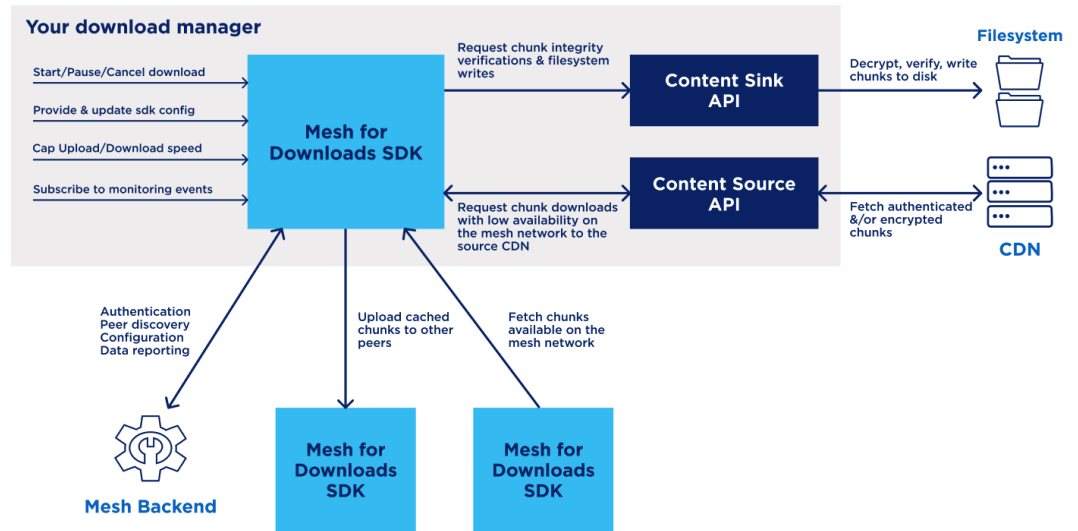
Specifications

Description	Details
Platform compatibility	Windows and macOS
Downloader format	C/C++ or .NET application. Integration samples are available here .
Security features	<ul style="list-style-type: none">• Mesh network content integrity check against source CDN.• Integration with your authentication system.• Fully encrypted communications with the backend (HTTPS)• Backend authentication for centralized P2P connection establishment service.• Fully encrypted DTLS mesh network communications
Matching features	<ul style="list-style-type: none">• Smart matching by network topology, ISP, country, region, city, etc.• Can restrict peer matching between specific ISPs or inside specific ISPs• Instant and seamless fallback to CDN delivery in case of any issues to avoid any impact on delivery• Can overcome short CDN downtimes by offloading delivery to the peer network
Dashboard & data API	<p>Graphs & APIs on near real-time and historical data including:</p> <ul style="list-style-type: none">• Delivered bandwidth (avg & max; CDN, P2P, total)• Download time-to-completion (avg & percentiles)• Download counts (started, completed, failed, canceled)• Delivered traffic volume (CDN, P2P, total)• Requested traffic volume• Mesh offload (percentage)• Active users (download, upload)• Error rates
Advanced data analysis	Custom CDN offload reports per customer upon request (paid service), accessing and compiling data from our data pipeline
Alerting and reporting	On-demand alerting service from our customer support if we detect anything unusual in different metrics: CDN offload, audience, QoS, new release, etc.
Dashboard configuration	<ul style="list-style-type: none">• Create properties to use different configuration options for different types of content• Wi-Fi and cellular network upload and download configuration• Activation Ratio feature for easy ramp-up and full control over the mesh network

Specifications

Description	Details
Client-side configuration and API	<ul style="list-style-type: none"> • Configuration: content ID P2P cache size, cap mesh upload & download throughput, cap P2P upload volume • Client API: session information, volume (CDN, P2P, total), throughput (CDN, P2P, total), Mesh sources, estimated time to download completion
Client-side optimization features	<ul style="list-style-type: none"> • UDP-based delivery, for better resource utilization than HTTP/TCP • 100% transparent for end-users with nothing to install • Adaptive Device Resource Usage: our module constantly monitors core health metrics on the device (CPU, memory, QoS, battery, etc.) to adapt the CDN offload algorithms to the capabilities of the device in real time • Advanced congestion control algorithms • Protection against uplink saturation via proprietary queue management

F1 SDK integration



The Mesh Delivery SDK integrates in your download manager once provided with two APIs:

- **Content Sink API:** Your download manager stays in charge of decrypting & writing content to the filesystem and can keep applying existing content integrity checks on content passed by our SDK.
- **Content Source API:** Your download stays in charge of communicating with your source CDN & understanding how your content is stored on the CDN.

Example implementations of content source & sink can be found [here](#).

The Mesh Delivery SDK can be integrated as:

- .NET native library via NuGet
- Plain C/C++ library

The API allows you to:

- Manage downloads lifecycle
- Dynamically override dashboard-set configurations
- Apply Upload & Download speed caps based on user preferences
- Subscribe to monitoring events such as CDN & P2P chunks downloads, peer connections establishments, states changes & errors

You can access the full SDK API: [CDN Mesh Download SDK API](#).

Why Lumen?

Lumen delivers trusted, high-performance live streams and on-demand content virtually anywhere in the world. Our powerful IP backbone connects you to AWS, Google Cloud and Microsoft Azure, and our CDN points of presence reach six continents with a mesh topology that deploys globally. For more information, contact us at content-delivery@lumen.com.

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