

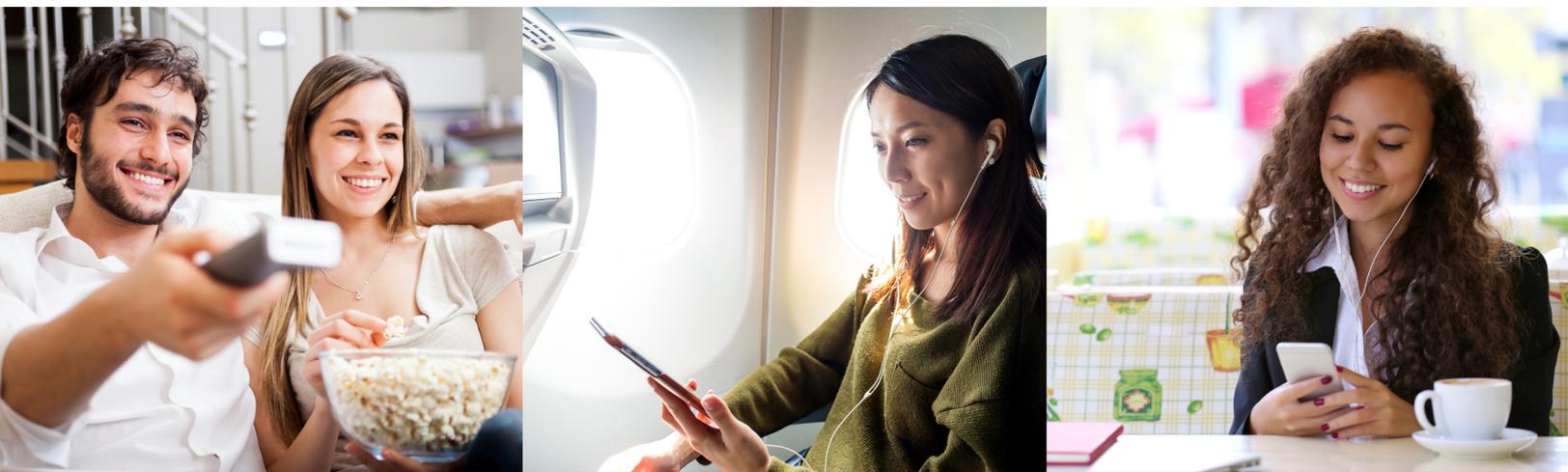


cedexis



Unified Streaming
Platform

How to Build a Private CDN for Video with Off-the-Shelf Components



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In this paper, we explore why a private CDN is an effective approach and how to build one.

Addressing the Challenge of High-Traffic Video Streaming

Streaming video has long been the venue of third-party commercial content delivery networks (CDNs). However, when a streaming service starts generating a lot of traffic, even a robust CDN can't stop dreaded buffering or slow video startup times.

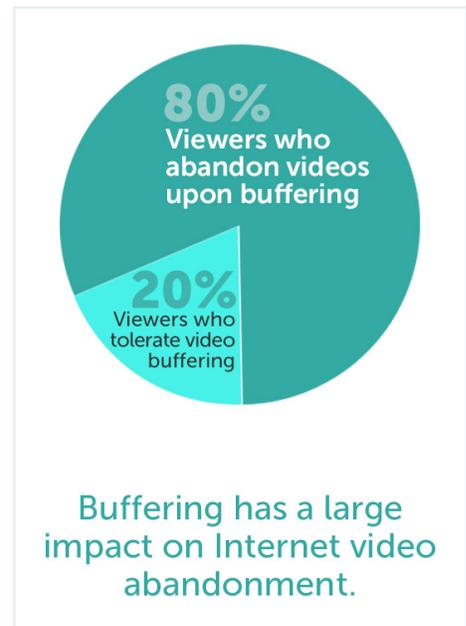
When a large CDN serves multitudes of content providers, all the segments required to offer a full video will never get into the cache. Flawless streaming video requires state-of-the-art content delivery. As Netflix and others have discovered, the best, most cost-effective path to high-performance video service is with a network of private hosting solutions and clouds that essentially act like a private CDN.

Until recently, this solution would have been too complicated, begging for outsourcing to a commercial CDN. New software packages, open source solutions and newer services make it possible to assemble a private CDN solution with off-the-shelf products. In this paper, we explore why a private CDN is an effective approach and how to build one.

We will show how to build one using a specific set of technology choices. With regard to the choices made in this paper: There are a lot of alternatives out there. We will try to indicate alternative solutions that could have been deployed along the way.

When a Third Party Won't Do

A Commercial CDN is a powerful tool for delivering easily cached objects to geographically diverse consumers. However, it is important to understand that they are not the last word in all content delivery. As a multi-tenant service they do not always fit the requirements for every enterprise, especially long tail content. The way CDNs are priced, they are often cost prohibitive for companies that target specific geographies. For certain delivery types such as streaming media, they often are not the right fit. If a video expires from the CDN's cache, a cache-miss can be expensive, cause delays, and trigger buffering for the end client.



Surprising fact: The best, most cost-effective way to provide video on demand is by building your own "private" CDN.

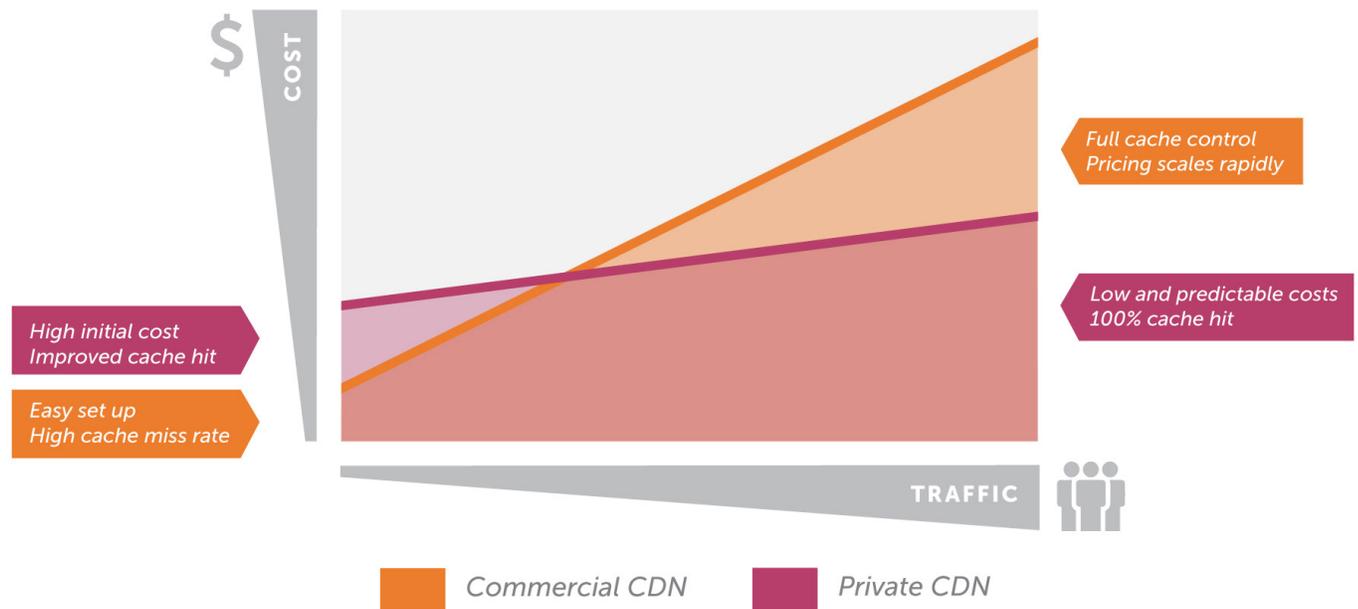


If a video expires from the CDN's cache, a cache-miss can be expensive, cause delays, and trigger buffering for the end client.

Viewer abandonment spikes as delays and buffering increase—80 percent of viewers abandon Internet videos the minute they start buffering. Eliminating these bandwidth and speed issues improve the quality of experience (QoE) and help keep viewers glued to your video.

Video-on-demand (VoD) uses lots of bandwidth to serve content. Digital videos aren't small, and with video quality increasing, they will only get bigger. Each gigabyte of throughput costs more when it's managed by a shared CDN service. A private CDN pays for raw connectivity without the overhead of a third-party CDN. This reduces the cost of bandwidth significantly.

Cost and Value of Building Your Own Private CDN



When does the greater control and the lower per-byte cost overwhelm the lower start-up cost? It happens quicker than you think.

A private CDN pays for raw connectivity without the overhead of a third-party CDN. This reduces the cost of bandwidth significantly.

Components of a Private CDN

A private CDN is a collection of points-of-presence (PoPs) that serve content exclusively for their owner. These PoPs come in a number of flavors. They can be bare-metal physical servers or virtual servers, and not all of them need to be origin servers. Some of these must act as origin servers, while others can act as caching servers or reverse-caching proxies.

A private CDN also needs a method for routing end users to the highest-performing PoP for the users' location and Internet topography.

Finding the Right Tools for the Job: Routing and Delivery

In addition to the hardware, hosting, and storage, you need software to build your private CDN. Two elements are particularly important. The first is a method for routing viewers to the fastest possible origin for video content. The second is a system to stream video content while providing the best QoE for the viewer.

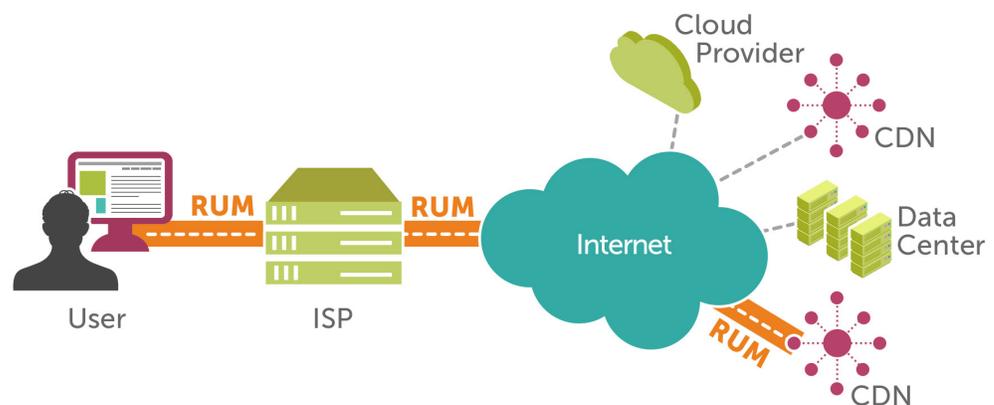
Intelligent Performance-Based Traffic Management

Cedexis Openmix can provide that first element, routing for performance.

Cedexis Openmix is an intelligent, performance-based solution for global traffic management. Using a number of metrics, it routes users to the best possible origin for content. Performance metrics are calculated in part by Cedexis Radar. Radar uses real user measurements (RUM) to discover the true network performance from origin to end device. The Radar measurements include the difficult-to-measure “last mile” of the Internet between the ISP and the end user.

However, performance-based routing isn’t just about network performance. With a private CDN, issues impacting performance include server load, local network outages, and hardware faults. Cedexis Openmix can take all of these into account when managing traffic.

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Cedexis Radar collects performance metrics from the content origin to the end user’s actual device. This true RUM takes into account the essential last mile of connectivity, giving the best possible picture of Internet performance.

Cost savings is one of the biggest incentives for implementing a private CDN. Openmix can avoid high-cost routes when bandwidth consumption pushes against the next pricing tier. Granular load balancing based on multiple variables

provides the best combination of QoE for the video consumer and resource efficiency for the video producer.

MUBI: A Film Festival in Your Device

MUBI is an online cinema available in over 200 territories. Its users prefer cult, classic, and award-winning films. Every day, MUBI's in-house experts hand-pick a film they love and make it available to members of the service, providing them a whole month to watch it. MUBI consistently maintains a perfectly curated selection of 30 films to enjoy.

MUBI's commitment to quality brings with it an inevitable technical impact. The service historically used a single CDN for VoD. The strategy was sound at first, but as the user base grew, a single-CDN solution could not keep pace. To deliver a multi-CDN solution that meets all of MUBI's needs, Cedexis turned to Unified Streaming for help.

Solution: Multiple POPs + Cedexis Openmix = Optimized Streaming

Anything short of 100 percent availability should be considered unacceptable. When a suitable infrastructure could not be found, MUBI built one. This proved to be the best way for MUBI to retain control over its distribution infrastructure and ensure quality of service.

MUBI set up its own delivery mechanism, relying on servers located in 10 different data centers across the globe. Cedexis Openmix provides the smart decision engine that routes every user to the best-performing region. There is no need for caching: end users directly access the server with the lowest latency and highest throughput at the moment they send a request.

Powerful, Simple Online Video Delivery

The second element needed to successfully build a private VoD CDN is online video streaming. Like global traffic management, video streaming can feel like a moving target. New devices, video formats, and encoding methods are hitting the market all the time. To deliver video successfully to every viewer, VoD software needs to keep up with bleeding-edge technology, and it needs to make streaming video easy.

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Unified Origin ingests any VoD or live video format and distributes it efficiently in any required format to the end user's device.

Unified Streaming is one solution to video delivery. It provides leading video and audio streaming technologies across all platforms and devices. Its products provide the robust, flexible tools needed to deliver video content from any source to any viewer.

Unified Origin is intended to reduce both complexity and cost for video packaging. In addition to VoD, it also transcodes and distributes live video feeds. Origin can unify content management and storage across platforms.

Media Server Options

Unified Streaming is the example media server that we focused on for this paper. There are a variety of options out there to consider, however.

Some popular media servers:

- Wowza
- Darwin
- Helix
- Adobe Media Server

This is an innovative, growing sector and new products are entering the market constantly. Keep an eye out for new offerings.

Unified Origin

Unified Origin is a software plug-in that allows industry-standard web servers like Apache or Nginx to deliver video content quickly and easily. Origin ingests a video in one format and then packages, applies DRM, and delivers the video to all formats on the fly.

Unified Packager

Unified Packager efficiently processes content for a snag-free user experience. Once packaged, content is ready for delivery to an origin server or a CDN for worldwide distribution.

Unified Capture

Unified Capture creates clips from any stream and performs frame-accurate cutting. It works with both live and VoD streams and allows broadcasters, content owners, and service providers to offer new services like nPVR, catchup-TV, and clips for social media.

Unified Remix

Unified Remix offers server-side dynamic manifest manipulation. It lets you fully customize your streams for both content and advertisements.

How to Build and Deploy a Private CDN

Understanding components like online video streaming and performance-based routing is critical to creating a private CDN. Let's take a look at an outline for a project plan to build and deploy one.

1. Gathering Your Tools: Video Content Management

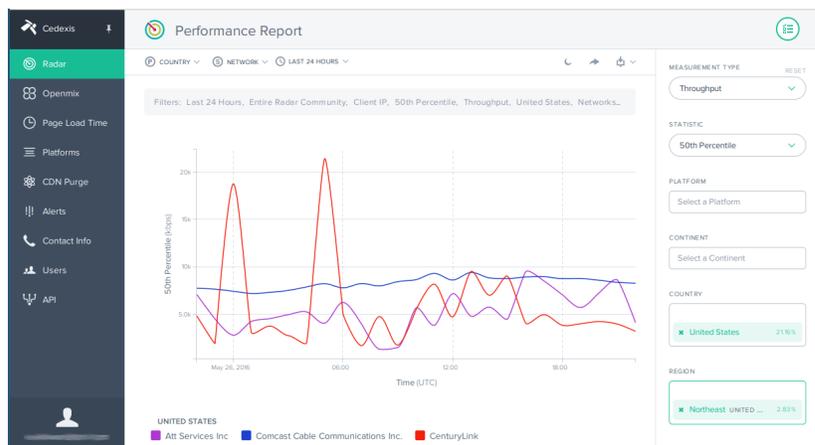
When preparing to stream video, understanding the source is key. Video content publishers might provide products via DVD, BlueRay, or digital media files in dozens of different formats. Live-video capture devices can output media in different bitrates and formats as well. All of this needs to be processed into an adaptive bitrate format for online video streaming. Software such as [Zencoder](#) is perfect for this task.

2. Deploying POPs: Building the Bare Metal

Without origin servers, you won't get very far. Bare metal is the best option for starting out. Owning the hardware means that you won't be sharing the most basic resources with noisy neighbors or abstracted virtual machines. The Cedexis Portal can be used to identify major networks and regions for POPs by analyzing community-wide RUM statistics.

"We have to keep an eye on I/O. At peak times, servers get hit pretty hard. We use SSD for the high demand content. But the ideal metric is network usage. We should be as close as possible to saturating the network before we saturate disk."

Zac Shenker, Senior Software Engineer, MUBI



The [Cedexis Portal](#) can be used to analyze network traffic by region and network in order to identify the major network providers to be targeted for a POP.

3. Delivering Content: Unified Streaming

Unified Origin from Unified Streaming is deployed on each of your origin servers. It is a software plug-in for industry-standard webservers like Apache, Nginx, Microsoft IIS, and Lighttpd. Origin will ingest the already-packaged video content created in step 2 and repackage it on the fly into the correct format for the client device.

4. Packaging and Digital Rights Management

Depending on licensing, digital rights management (DRM) is an issue that needs to be addressed during content delivery. Videos are protected with DRM keys using a tool such as Unified Origin, which applies DRM at delivery time.

5. Cedexis Openmix: Route Users to the Best Video Origin

Now that you have deployed servers, packaged video, and implemented a streaming solution, you have to connect your users to the best possible origin server. Cedexis Openmix uses Radar's immense collection of RUM metrics to figure out which origin is the best for each viewer—even midstream!

6. Expanding Your Service: Repeat as Needed

Finally, as your number of viewers expands, more POPs will be needed. The powerful analytics tools in [Cedexis Portal](#) help you figure out where your next POP should be deployed. Maybe your next POP will need to be overseas!

“When we start investigating new data centers, we start with small-scale deployments. We deploy a Cedexis Radar node and start to collect data for a month or two. From that we are able to see improvements all the way down to the ISP level.”

Zac Shenker, Senior Software Engineer, MUBI

Expanding Intelligently

Growth does not need to be a guessing game. As a VoD service takes off and traffic expands globally, new geographic markets create new performance challenges. This means a VoD service needs to expand into new private data centers to handle additional traffic from new sources.

The [Cedexis Radar portal](#) is a powerful tool for determining key underserved regions. Its analytical tools pinpoint and identify regions that could be served by additional origin servers. A simple API call via a JavaScript tag or other embedded resource sends customized metrics to Radar.

Cedexis Radar collects billions of RUM metrics daily, giving the best possible picture of Internet health.



HOW TO BUILD A PRIVATE CDN FOR VIDEO WITH OFF-THE-SHELF COMPONENTS

ABOUT UNIFIED STREAMING

Unified Streaming

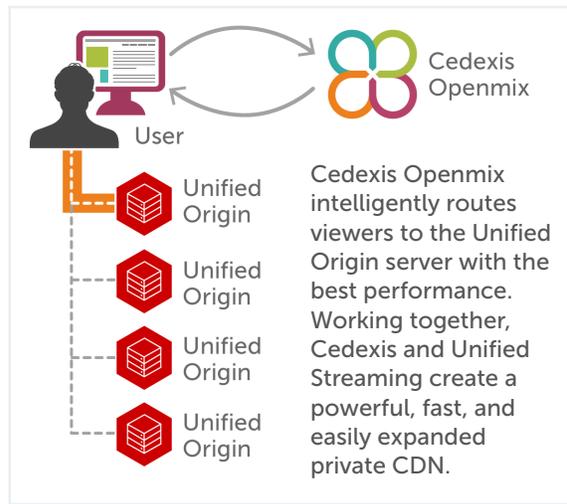
is a leader in video streaming technologies across all platforms and devices. Their customers and partners span the globe, from international live news broadcasters and major TV networks to media service providers and technology partners.

ABOUT CEDEXIS

Founded in 2009, Cedexis optimizes Web performance across data centers, CDNs, and clouds for companies that want to ensure 100 percent availability and extend their reach to new global markets.

Cedexis Radar collects billions of RUM metrics daily, giving the best possible picture of Internet health. With the knowledge of actual end user experiences, a content provider like MUBI has the insight to intelligently add POPs in the right locations to increase the user experience.

Radar also provides the tools needed to locate data centers and service providers who would provide the highest quality content delivery to specific regions. This gives VoD providers the edge they need to select the right provider when deploying new private CDN nodes.



Likewise, Cedexis Radar helps identify data centers that are not handling their share of the work. This insight into real-world video performance is key to maintaining and expanding a private CDN.

Building a Platform for Growth

A private VoD CDN requires intelligent routing, efficient video delivery, and an eye for network performance detail.

The result is a highly customized video delivery system with the best performance for each customer base.

Explore Cedexis Radar and Openmix to learn more about performance-based global traffic management. For more information on powerful cross-platform VoD, read more about [Unified Origin](#).

With deep experience in delivery networks and performance optimization, **Cedexis** is the global expert in multi-cloud and multi-CDN strategies. Today, over 500 media, retail, luxury, and consumer brands count on Cedexis for 100 percent availability, optimal Web performance, flexibility, and choice that drives revenue and lowers cost and risk.

Visit cedexis.com or email sales@cedexis.com.

Unified Streaming is a forerunner in the creation of smart video streaming technologies for multiple platforms and devices. Founded in 2007 and headquartered in Amsterdam, the Netherlands, Unified Streaming helps stream and protect content all over the world, every second of the day.

Visit unified-streaming.com or email sales@unified-streaming.com.

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