



BIRLA VISHVAKARMA MAHAVIDYALAYA

CONTENT DELIVERY NETWORK

Delivering the Web, Faster.

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The Problem: High Latency

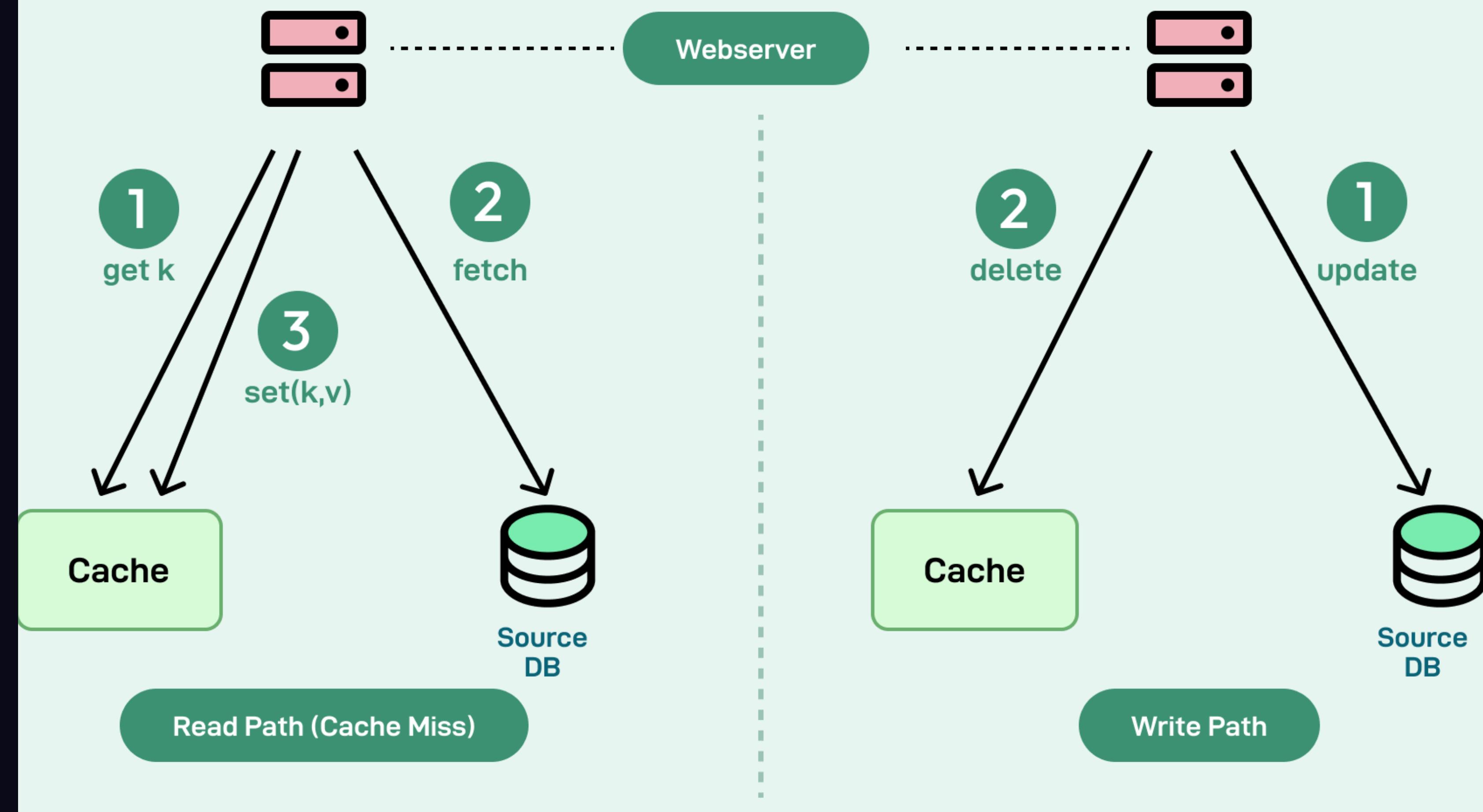
The Distance Delay

Every web request must travel a physical distance. A user in Australia visiting your server in New York creates a long-distance connection.

This physical gap creates a significant delay known as **“latency”**. This is the time it takes for data to travel back and forth.

The result is slow page loads, buffering videos, and a frustrating experience that drives users away.

| How Caching Works



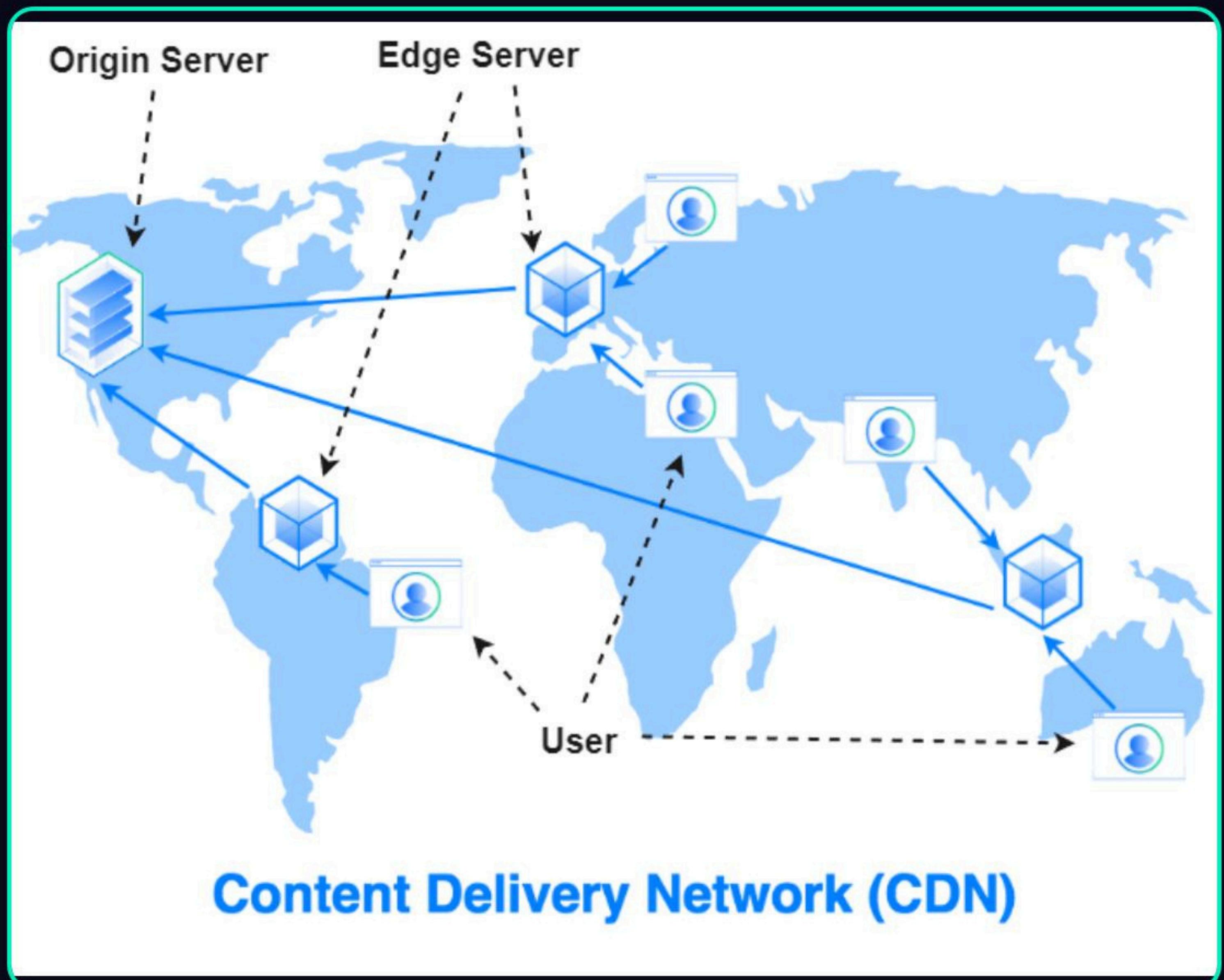
The Solution: What is a CDN?

Bringing Content Closer

A Content Delivery Network (CDN) is a geographically distributed network of proxy servers.

It solves the latency problem by caching (storing) copies of your content (images, videos, webpages) in "Points of Presence" (PoPs) that are physically close to your users.

When a user requests content, they are served from their *nearest* PoP, not the distant origin server.



Key CDN Terminology



Origin Server

The single server (or cluster) that hosts the original, definitive source of your website's content. All CDN servers pull content from here.



Edge Server (PoP)

A "Point of Presence" (PoP) is a data center containing CDN servers. These are the servers at the "edge" of the network, physically closest to the end-users.



Caching

The process of storing copies of your files (like images, JS, CSS) on Edge Servers. This allows the CDN to deliver content without asking the Origin Server every time.

How It Works (A Simple Flow)

1. User requests content (e.g., an image).
2. DNS routes the request to the nearest CDN Edge Server.
3. Cache Hit: If the server has the image, it delivers it immediately. (Fast!)
4. Cache Miss: If not, the Edge Server gets the image from the Origin Server, caches it for next time, and then delivers it. (Slower first time, fast for everyone else nearby).



Key Benefits

-  Faster Load Times: By reducing latency, content loads significantly faster, which improves user experience and SEO rankings.
-  Improved Reliability & Scalability: Traffic is distributed across many servers, preventing a single origin server from being overloaded by a traffic spike.
-  Lower Bandwidth Costs: By caching content at the edge, CDNs dramatically reduce the amount of data the origin server must send, lowering hosting bills.
-  Enhanced Security: Most modern CDNs provide a front-line defense against Distributed Denial-of-Service (DDoS) attacks and offer other security features.

Potential Disadvantages

-  Cost: While they save on bandwidth, the CDN service itself has a cost, which can be high for high-traffic global sites.
-  Complexity: Configuration can be complex. Setting up cache rules (like TTL - Time to Live) and knowing when to "purge" or "invalidate" content is crucial.
-  Stale Content: If the cache is not purged correctly after a website update, users may continue to see old, outdated content.
-  Third-Party Reliance: Your website's performance becomes dependent on your CDN provider. An outage at the CDN can take your site down.

Case Study: Netflix Open Connect

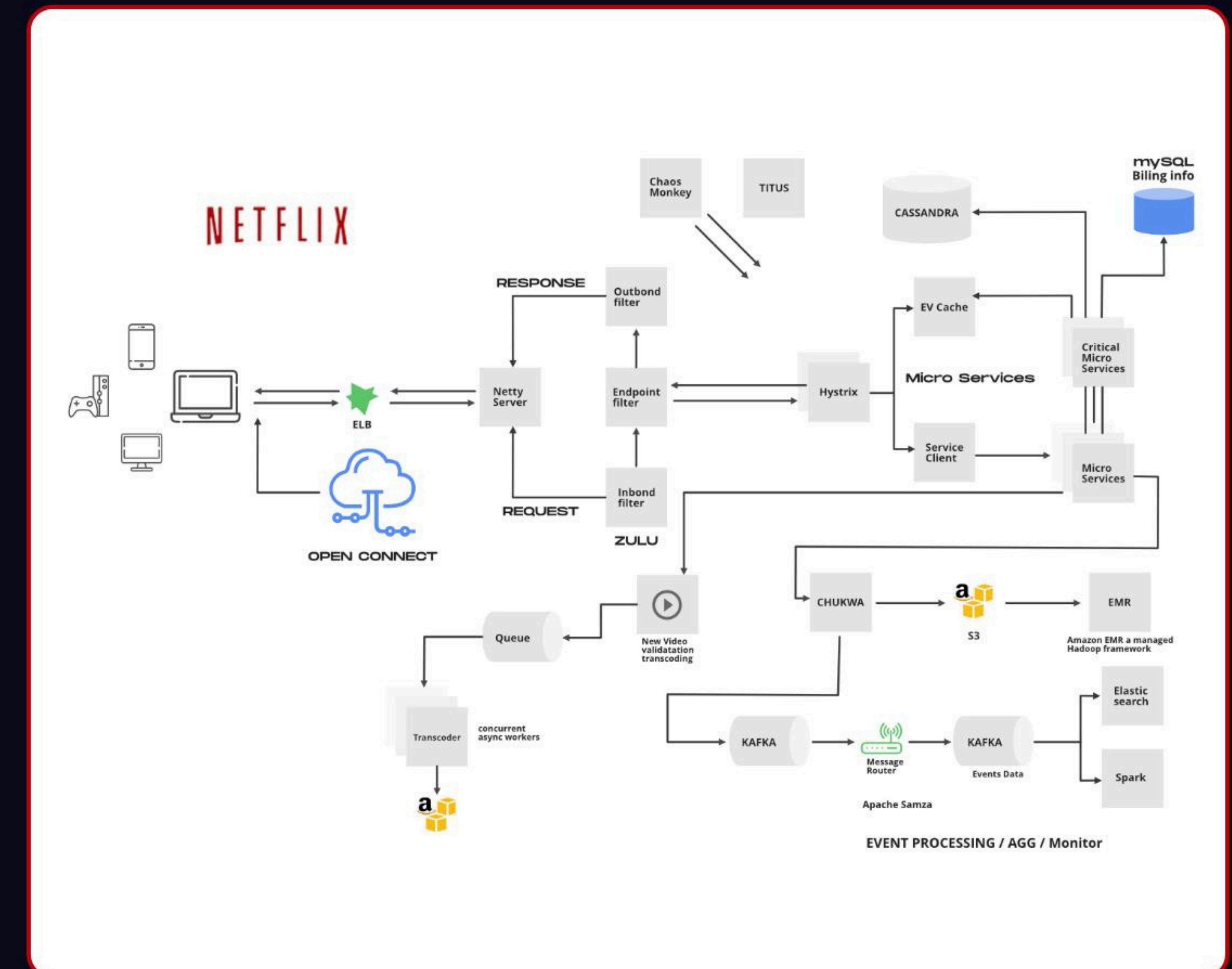
Building Their Own CDN

Netflix handles over 15% of all global internet traffic. Relying on third-party CDNs was too expensive and inefficient.

Solution: They built their own global CDN called Open Connect.

They partner with Internet Service Providers (ISPs) to place their red "Open Connect Appliances" (OCAs) *directly inside* the ISP's data centers, for free.

This means video content is served from within the user's local network, providing flawless 4K streaming and saving Netflix and ISPs billions in traffic costs.



Technical Architecture (How It's Made)



1. DNS Routing

CDNs use smart DNS (often GeoDNS) to route a user's request. It detects the user's location and sends them to the IP address of the *nearest* Edge Server (PoP).



2. Reverse Caching

The Edge Servers run high-speed reverse-proxy cache software (like Nginx, Varnish, or custom tech). They act as a "shield" for the Origin, storing and serving static content.



3. Distributed PoPs

The core "product" is the physical network itself. A CDN is a massive, global infrastructure of data centers built to minimize the physical distance to any user on Earth.

Resources for Further Reading



Major CDN Providers:

AWS CloudFront, Google Cloud CDN, Akamai, Cloudflare, Fastly



Learning Centers:

The "Learning" sections on the Cloudflare and AWS websites are excellent free resources.



Key Concepts to Search:

"GeoDNS Routing", "Cache Invalidation", "Time to Live (TTL)", "Edge Computing"



Case Studies:

Search for "Netflix Open Connect" and "How Facebook's CDN Works".

Thank You

Questions?

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Image Sources



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