Robosoft Technologies®
EMOTION ENGINEERING & DESIGN

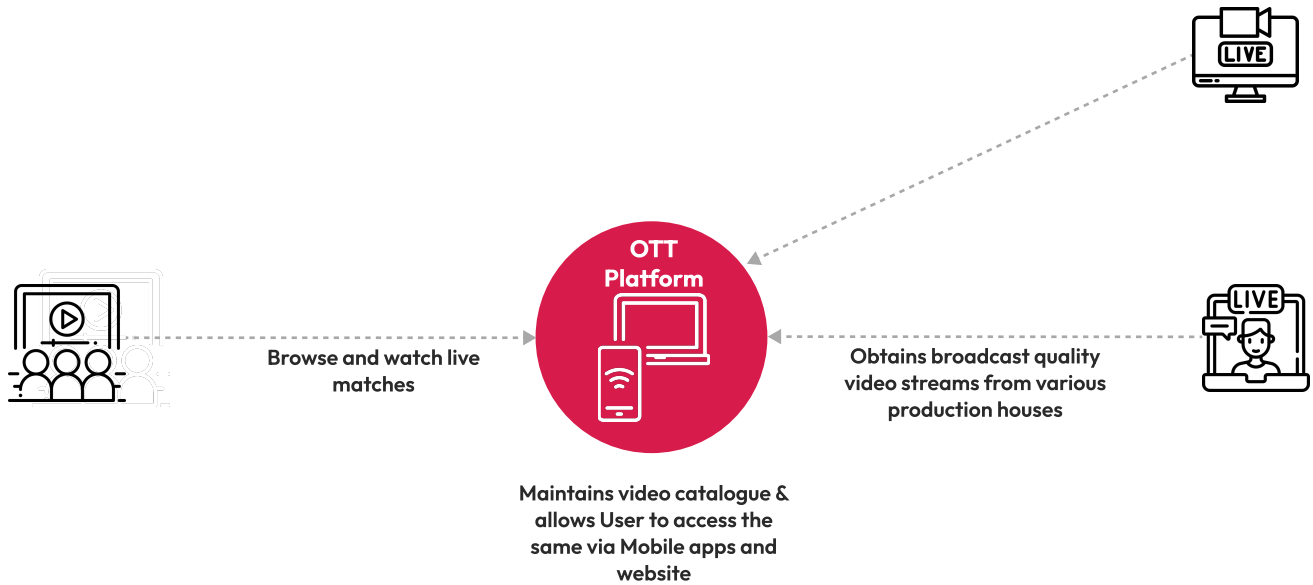
# Architecture of a Live Sports Streaming Platform

The world of sports has always held an undeniable allure, uniting fans across borders and cultures. Recent sporting events like the FIFA World Cup 2022 and the ICC Cricket World Cup 2023 have showcased the global passion for sporting spectacles, with peak matches captivating billions of viewers worldwide. Imagine the sheer scale of these events – 30 UHD cameras capturing every minute detail of the game, broadcast in real-time to an audience of millions.

Have you ever wondered how this seamless delivery of live sporting events is achieved? How does the video capture from a stadium reach the screens of millions of devices with such speed and precision? Behind the scenes lies a complex yet fascinating technological infrastructure, a symphony of hardware and software that orchestrates the delivery of live sports streaming.

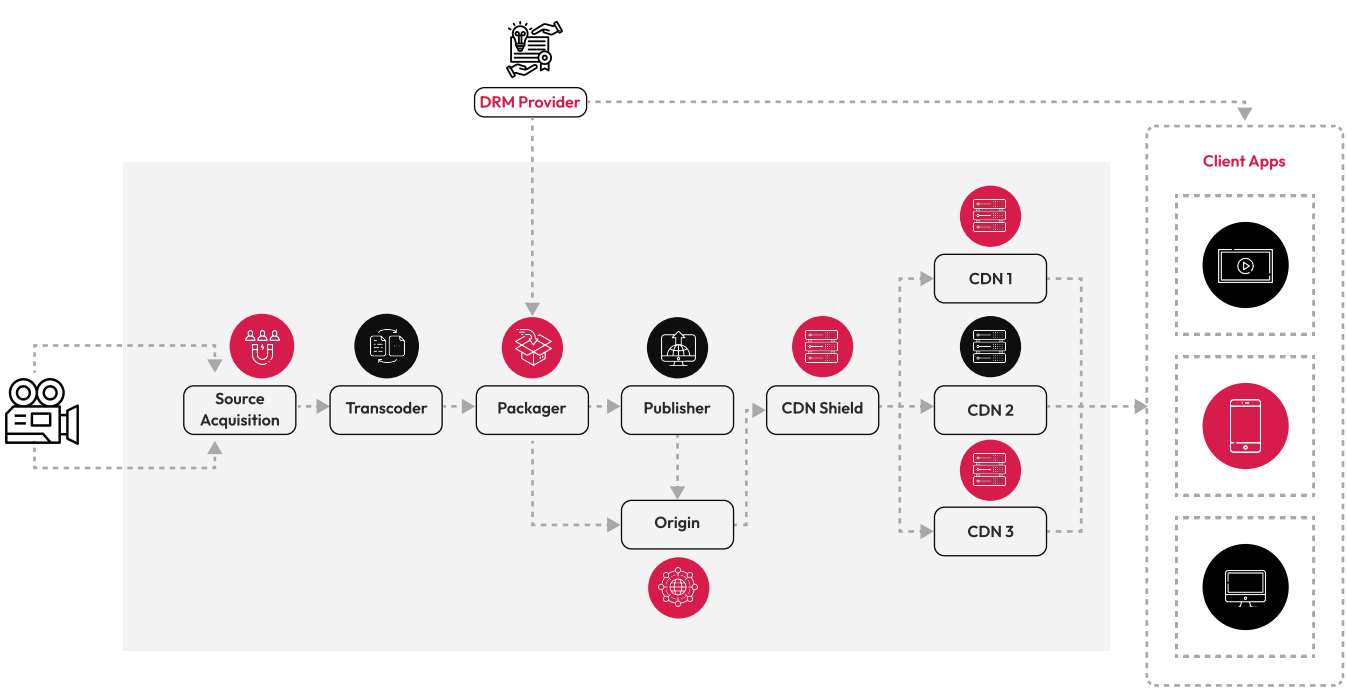
This article delves into the intricate workings of this technological marvel, exploring the journey of live video content from its capture to its delivery to millions of devices worldwide. While existing components like user management, subscription management, and client apps can handle live video streams, the media preparation and delivery platform cannot directly control the live stream. A new implementation is required alongside the VOD pipeline. Our focus lies on the technical aspects of live sports streaming, excluding general OTT platform elements like user management, subscription management, and client apps.

**The below diagram gives you a 30000 ft view of the ecosystem.**




# Live Sports Streaming Platform Architecture: A Comprehensive Overview

The live sports streaming platform is designed to deliver high-quality, real-time video content to a large user base. Its architecture comprises several interconnected components that work in tandem to ensure a reliable and engaging streaming experience. The diagram below depicts some of the most critical parts of a streaming platform.



# Source Acquisition

Source ingestion/acquisition in a live sports streaming platform refers to receiving live video feeds from various sources, typically over a secure network connection. Managing source ingestion involves several key steps and components. Some of the important ones include:

### 1. Source Acquisition

Establish connections with providers of live video feeds. These sources may include cameras at the event venue, satellite uplinks, remote streaming devices, and other sources of live video content. In most cases, the feeds will be edited video streams. Live video feeds are transmitted as MPEG transport streams over the public internet. The stream format may be MPTS (Multiple Program Transport Stream) or SPTS (Single Program Transport Stream).

### 2. Transport Protocol

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### 3. Stream Validation

Verify that the incoming video stream meets the specified requirements, including resolution, bitrate, codec, and format. This step is crucial for identifying and addressing potential issues with the incoming feed.

### 4. Redundancy and Load Balancing

Implement redundancy in source ingestion to guarantee high availability and dependability. This may include utilizing backup sources or redundant servers. Additionally, load balancing can be used to distribute incoming streams across multiple servers to prevent bottlenecks and ensure optimal performance.

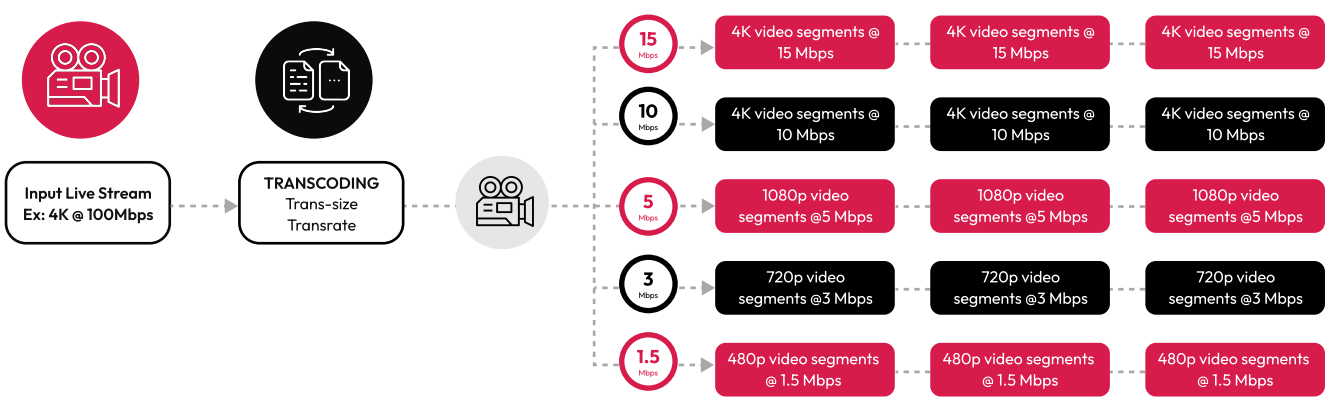
### 5. Error Handling

Implement robust security measures to safeguard against unauthorized access to the source ingestion system. This may include encrypting the incoming streams and enforcing stringent server access controls

Effective management of source ingestion is paramount to delivering a seamless and dependable live sports streaming experience for viewers. It encompasses a blend of hardware, software, and operational procedures designed to navigate the complexities of managing live video feeds from many sources. By meticulously orchestrating the acquisition, validation, and ingestion of live video streams, broadcasters can ensure uninterrupted delivery of high-quality content to their audience.

## Transcoder

Transcoders are pivotal in preparing video content for distribution to various devices and network conditions within a Live Sports Streaming Platform. Fundamentally, transcoding involves converting content from one codec to another. In live sports streaming, transcoders handle the real-time processing of video feeds, transforming them into a codec compatible with the packager. This ensures that the live video stream undergoes continuous transcoding and is prepared for distribution as it arrives.




Some of the essential roles include:

### 1. Adaptive Bitrate Streaming (ABR)

The transcoder generates multiple versions of the original video feed at different resolutions and bitrates, known as ABR. This results in a collection of video streams with varying quality levels, enabling viewers with diverse internet speeds and device capabilities to experience the stream at a suitable quality.

2. **Segmentation**

The transcoder partitions the video content into smaller, more manageable segments. This segmentation is critical in adaptive streaming, where the viewer's device can seamlessly switch between different quality levels based on the available bandwidth. By segmenting the video into smaller chunks, the transcoder enables the platform to dynamically adjust the stream’s bitrate to match the viewer's network conditions, ensuring a smooth and uninterrupted viewing experience.

3. **Bandwidth Optimization**

The source video stream often possesses very high quality, which can lead to excessive bandwidth consumption. Transcoders address this challenge by employing compression techniques to reduce the bandwidth required for delivering video content. This optimization is crucial for reaching viewers with limited network bandwidth, ensuring they enjoy a smooth and consistent streaming experience.

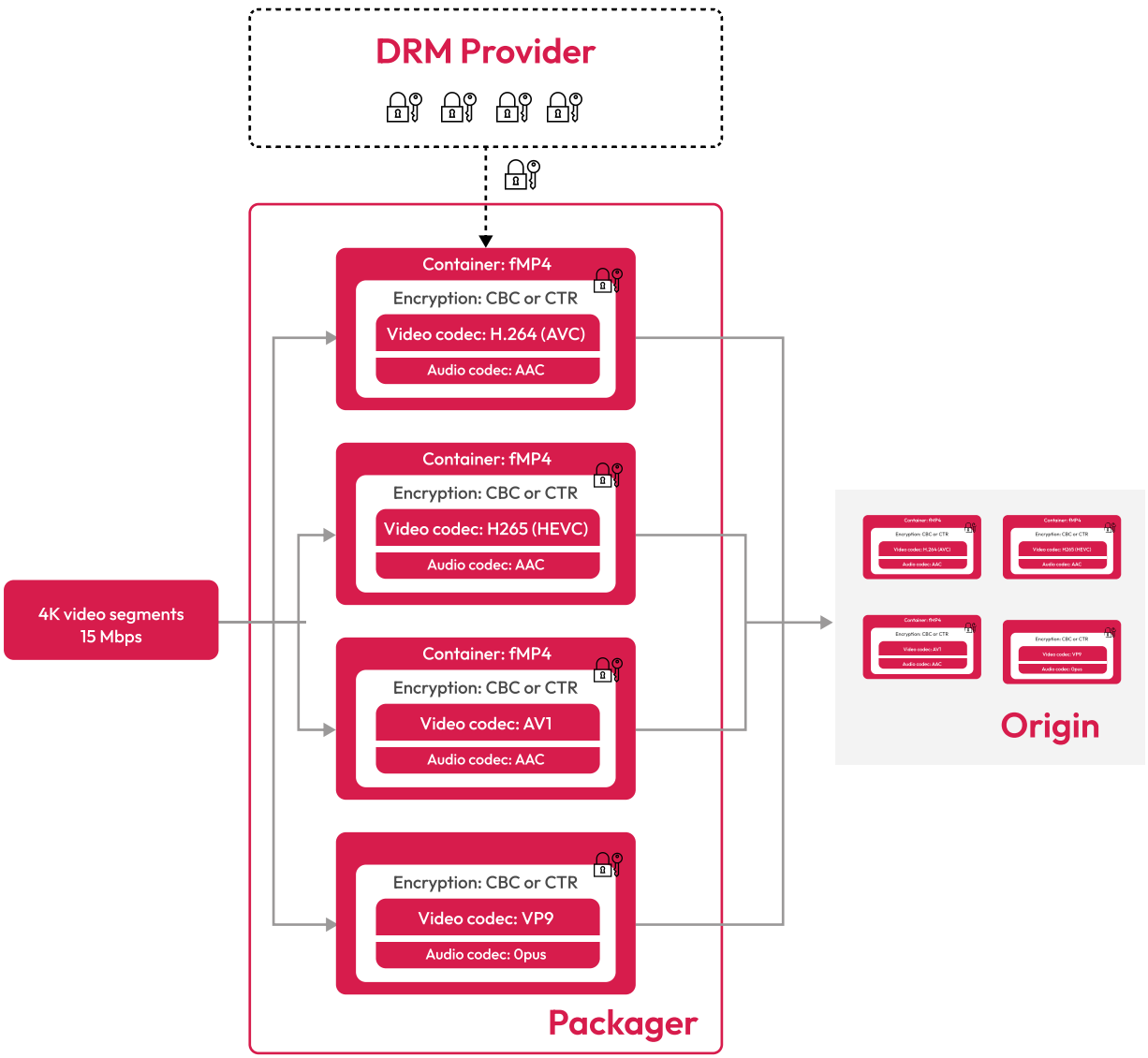
4. **Device Compatibility**

A transcoder ensures the video is available in formats and resolutions suitable for various devices, including smartphones, tablets, desktop computers, smart TVs, and more. This caters to the current device landscape's diverse screen sizes and capabilities. By providing multiple renditions of the video stream, the transcoder enables seamless playback across a broad spectrum of devices, ensuring that viewers can enjoy the content regardless of their device choice.

The transcoder's output consists of video segments in various renditions, each tailored to specific device capabilities and network conditions. These segments are then forwarded to the packager to create the video package. Additionally, a portion of the transcoded output may be stored in the Origin server for the Live-to-VOD service. This service generates a Video on Demand (VOD) version of the live event, enabling viewers to access and replay the event at their convenience.

# Packager

Packaging encompasses preparing and formatting video content into a container for efficient end-user delivery. Some of the essential roles include:



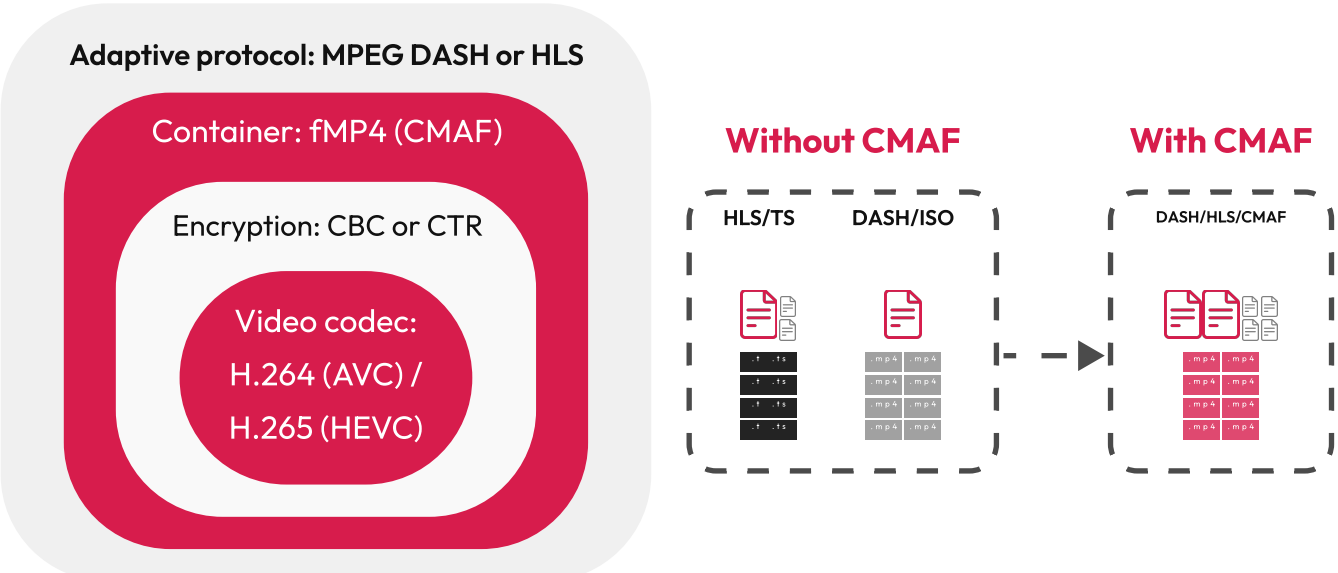

## 1. Format Conversion

The packager ensures the video content is formatted according to the chosen streaming protocol. For example, depending on the viewer's device's support, it might convert the segments into H.264, H.265, VP9, AV1 codecs, etc.

## 2. Packaging

It packages the segments in a container supported by the HTTP streaming protocols. For instance, Apple's HLS protocol uses the MPEG transport stream container format (MPEG-TS). Other HTTP-based protocols, such as DASH, use the fragmented MP4 format (fMP4). These formats are optimized for delivery over HTTP and support adaptive streaming.

Common Media Application Format (CMAF) is a relatively new format for packaging and delivering various forms of HTTP-based media. This standard simplifies media delivery to playback devices by working with HLS and DASH protocols to package data under a uniform transport container file.



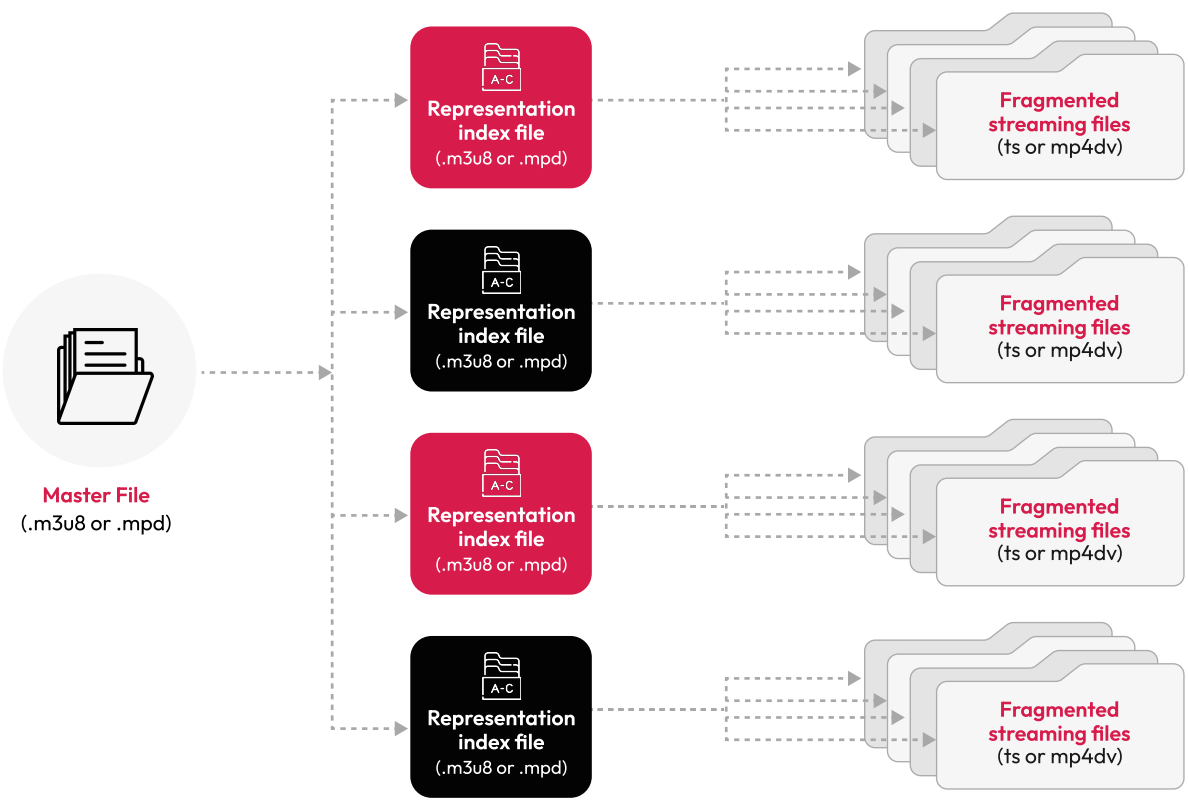

### 3. Encryption and DRM

To safeguard content, the packager can apply encryption to the video fragments. Additionally, it can integrate with Digital Rights Management (DRM) systems to prevent unauthorized access and piracy. The DRM provider can be either an internal component or an external system.

The packager generates video segments encapsulated in various containers. The publisher references these containers to make the video content available for distribution. The packager stores the video segments on the origin server.

# Publisher

HTTP streaming manifest plays a pivotal role in delivering video content over the internet using protocols like HTTP Live Streaming (HLS) or Dynamic Adaptive Streaming over HTTP (DASH). The playlist instructs the video player to request and play the content. A manifest is a text file that encapsulates information about the video/audio segments, their characteristics, and the URL to retrieve each component.



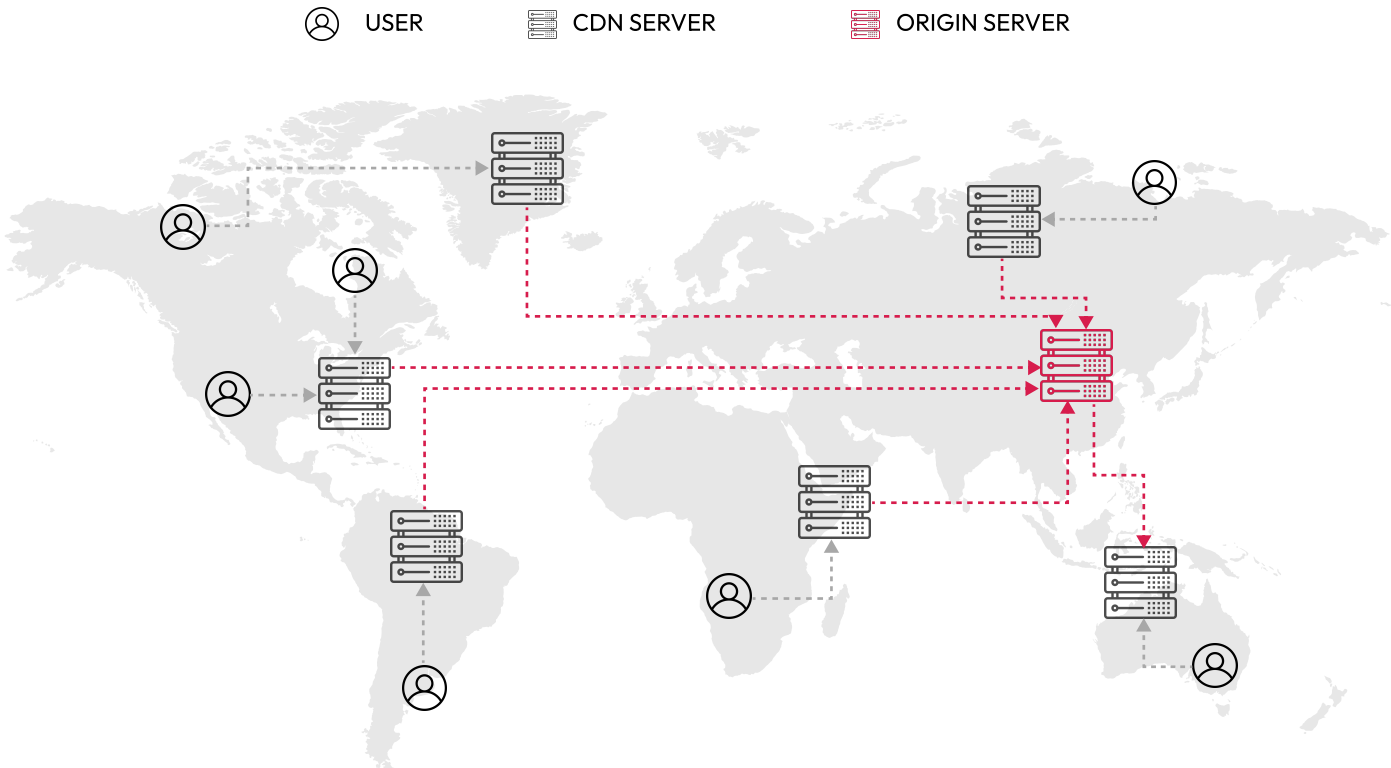

# Origin

The origin server, sometimes called the origination service, serves as the distribution point for live video content to viewers. It is a central repository for storing all live content and provides high-performance storage capabilities essential for media delivery. The origination service collaborates with the CDN to ensure efficient content distribution to end-users.

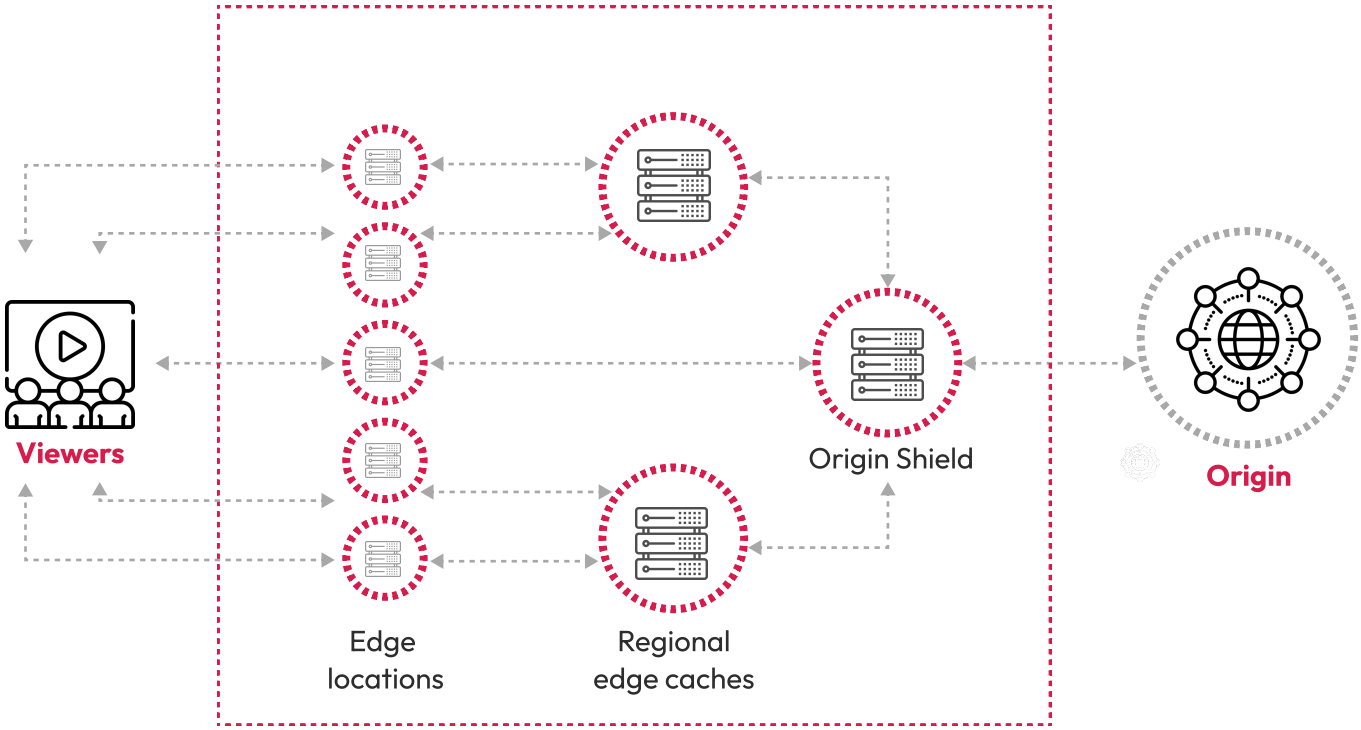
# Origin Shield and Multi-CDN

## Content delivery network

CDNS cache content from the origin server on geographically distributed CDN cache servers to reach users faster.




Content Delivery Networks (CDNs) strategically position geographically dispersed servers across the globe. These servers cache and store content closer to end-users, including manifests, video/audio, and text segments. This proximity enables end-users to experience live streams with minimal latency and rapid startup times. Akamai, CloudFront, and Fastly are among the leading CDN providers. Utilizing a CDN provider is a prevalent practice for most internet-based applications. Multi-CDN integrates CDNs from various providers into a single, expansive global network. Multi-CDN adoption is widespread among live-streaming platforms.

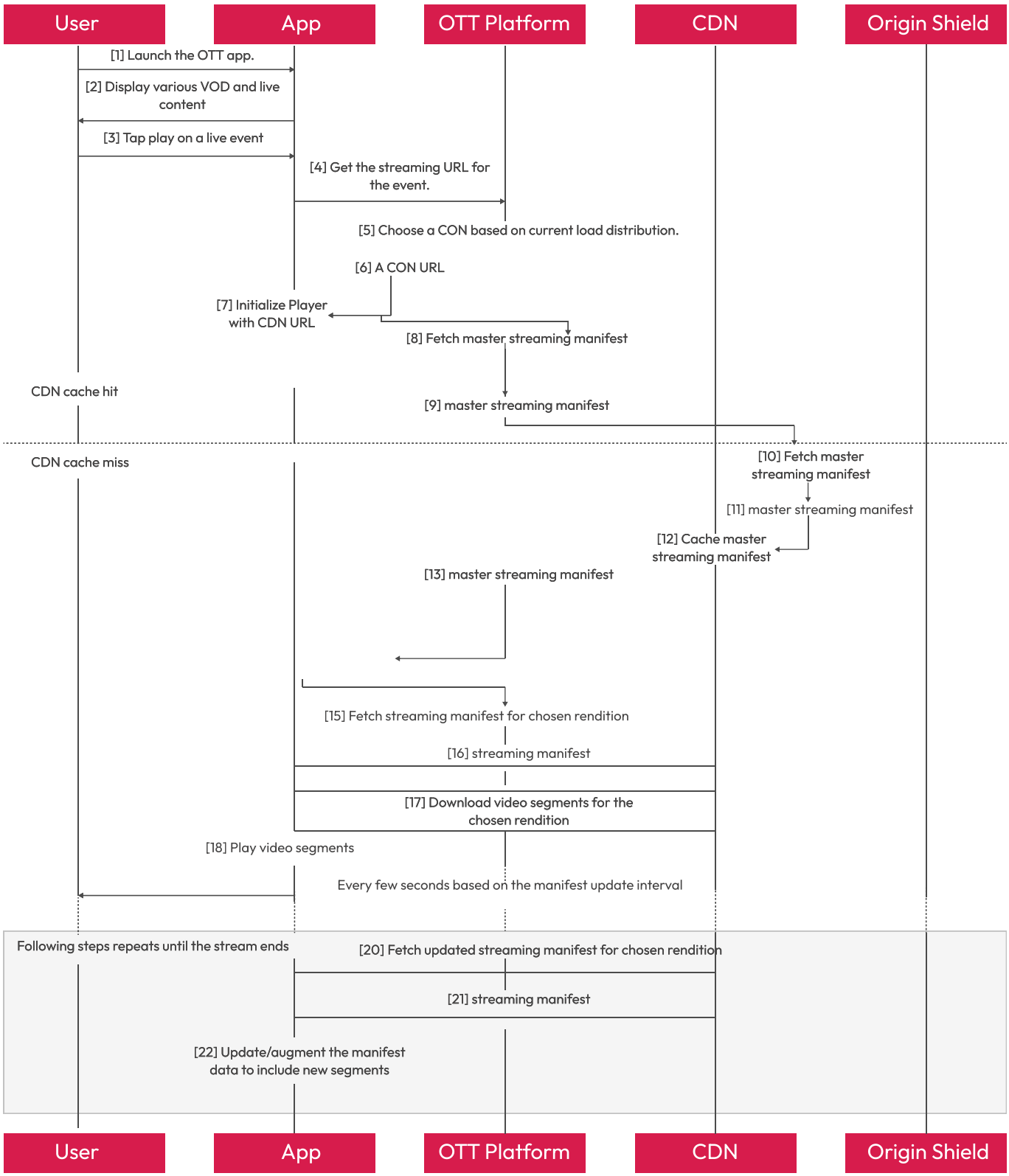



A CDN typically connects to a single Origin when an incoming request is not in its cache. Conversely, a live streaming platform frequently employs an Origin Shield. Origin Shield is an additional caching infrastructure layer that helps reduce the load on your Origin and improve its availability. The Origin Shield is situated between the Edge CDNs and the Origin.

Origin Shield can help enhance the cache hit ratio of the edge CDNs by providing an additional caching layer in front of the Origin. All requests from all edge CDNs to the Origin pass through Origin Shield, boosting the likelihood of a cache hit.

Origin Shield can further minimize the simultaneous requests sent to the Origin for the same object. Requests for content not cached in Origin Shield are consolidated with other requests for the same content, resulting in as few as one request being sent to the Origin.

# How it all works?



# Conclusion

The architecture of a live sports streaming platform is a complex and fascinating system that enables millions of viewers worldwide to enjoy real-time coverage of their favorite sporting events. From the high-resolution cameras capturing every minute detail of the game to the sophisticated software that orchestrates the delivery of live video streams, each component plays a crucial role in ensuring a seamless and enjoyable viewing experience.

The technical advancements in live sports streaming have revolutionized how we consume sports, transforming it from a spectator sport into a global phenomenon. By delving into the intricate workings of this technological marvel, we gain a deeper appreciation for the behind-the-scenes efforts that bring the thrill of live sports to our screens.

As technology evolves, we can expect even more revolutionary approaches to live sports streaming. Imagine the immersive experiences that await viewers on devices like Apple Vision Pro, placing you right in the heart of the action, feeling the energy as if you're there in person. The future of live sports streaming is dazzlingly bright, promising to captivate and entertain us for years to come.

# About Us

Robosoft Technologies is a proven digital transformation partner with a track record of crafting 10+ leading OTT streaming platforms, enjoyed by millions across the globe. Our services include Digital product strategy, Customer Experience Design, Platform Engineering, Testing, QA and Data Analytics.

Robosoft empowers Media and Entertainment brands with digital solutions that unlock deeper customer engagement and boost revenue. We translate end-user needs into feature-rich, cross-platform experiences that elevate them from the ordinary to the extraordinary.

We deliver end-to-end solutions in OTT streaming for media & entertainment brands at every stage of the brand journey: (a) build from scratch (b) revamp an existing platform or (c) re-imagine and scale an established platform.

## We work with Media, News & Entertainment brands in:

- Platform strategy
- White-label applications
- Out-of-the-box Video CMS
- Cross-platform application development
- Smart TV app
- Monetization strategies

## We are chosen for our expertise in:

- Digital product strategy and design thin king-led workshops
- Customer Experience Design including seamless UI/UX across devices & platforms
- GTM Strategy
- Native and Cross-platform Application development & maintenance across mobile, web & tablets
- Testing-as-a-service
- Data and Analytics

## Our engagement models include:

- Digital Centre of Excellence
- Offshore Technology Centre
- Customer Team Augmentation
- Managed T&M
- Package implementations
- Turnkey Projects

# Brands you trust, trust us

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