



MAINSTREAMING®

The Intelligent Media Delivery Company.

Live and On-Demand, Globally.

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| Agenda

- Quality of Experience (QoE)
- CMCD+
- Anti-Piracy



Quality of Experience (QoE)



Market development and challenges for the industry...



Challenges of broadcasters and OTT Services





MAINSTREAMING[®]

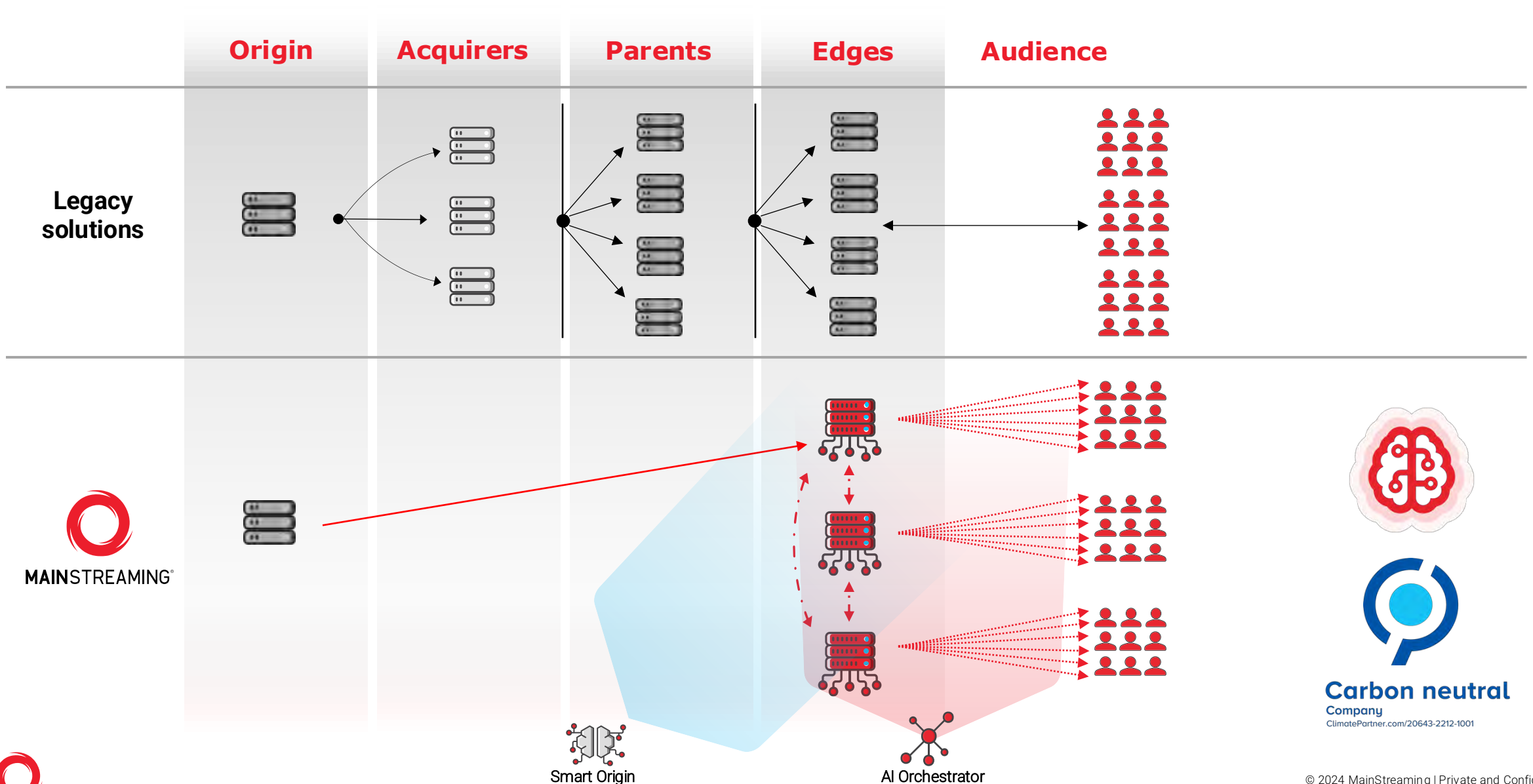
Our Technology



**Smart Edge Architecture
+
Intelligent Media Delivery**



Smart Edge Architecture



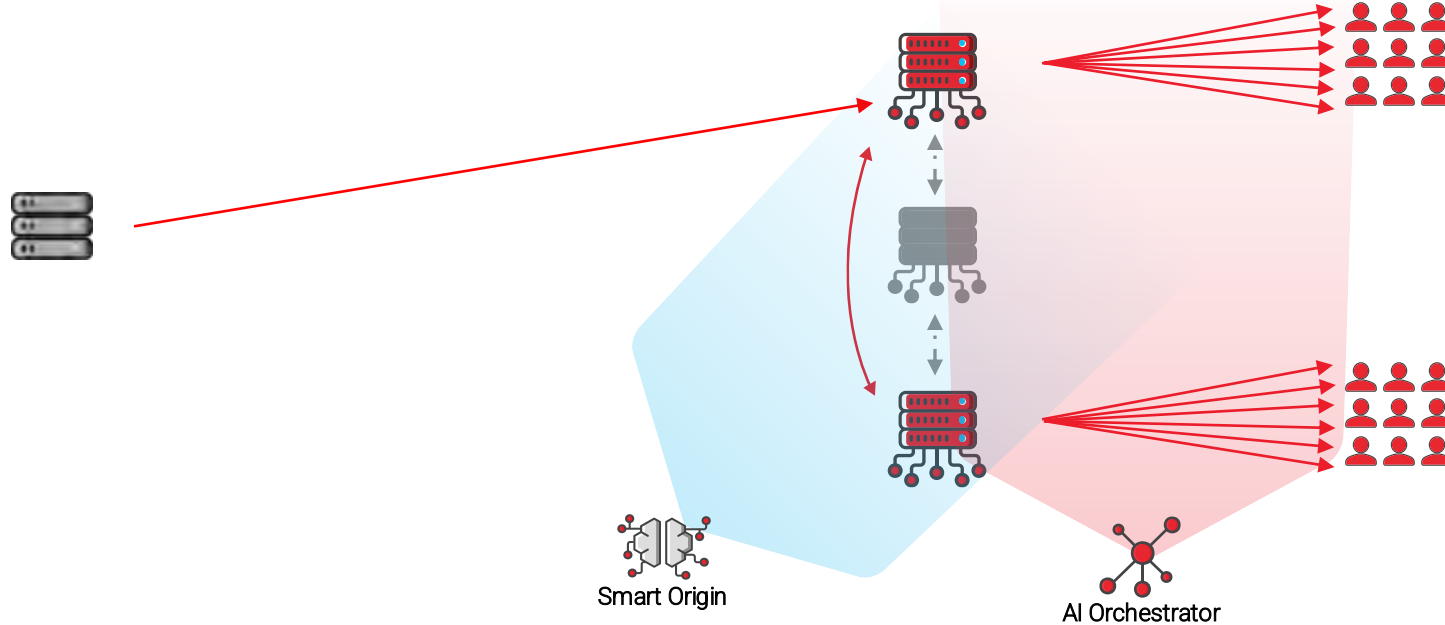
Carbon neutral
Company
ClimatePartner.com/20643-2212-1001

Smart Edge Architecture - Live Content Distribution

Origin

Edges

Audience



Smart Origin

AI Orchestrator

Get the best video quality from the Origin server

Contents are requested just once from Origin servers, avoiding rebuffering and streaming errors while protecting the Origin from overload and minimizing network traffic.

Define network path based on KPI feedback loops

Advanced viewers location detections, and the ability to coordinate all streaming resources on the fly lead to a proper connection of the viewers to the best and closest EDGE server, thus granting broadcast-grade QoE



Smart Edge Architecture - VOD Content Distribution

Origin

Edges

Audience



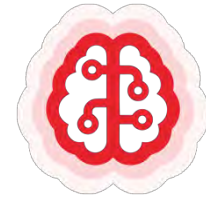
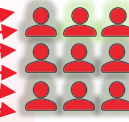
Content 1



Smart Origin



AI Orchestrator



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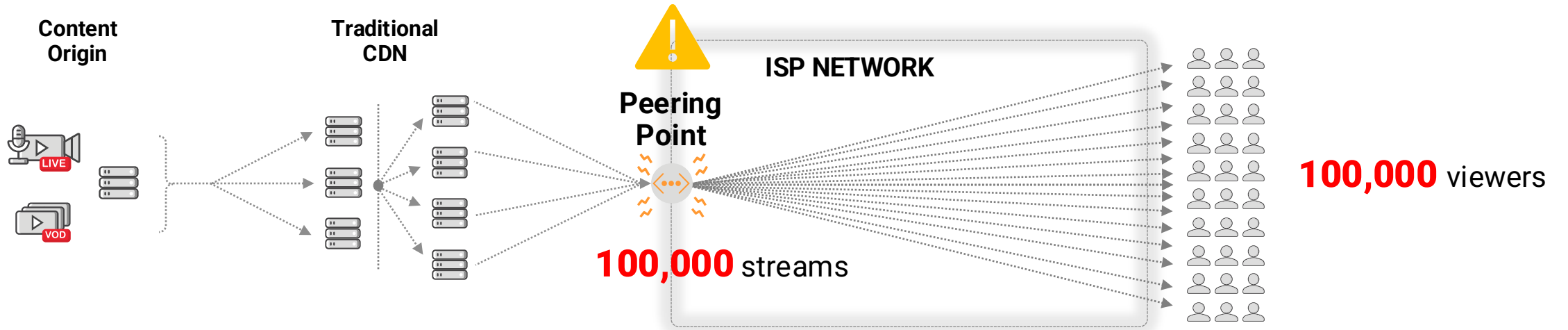
«**Smart Origin**» balancing VOD cached content on the Edges
«**AI Orchestrator**» connecting viewers to the most suitable Edges



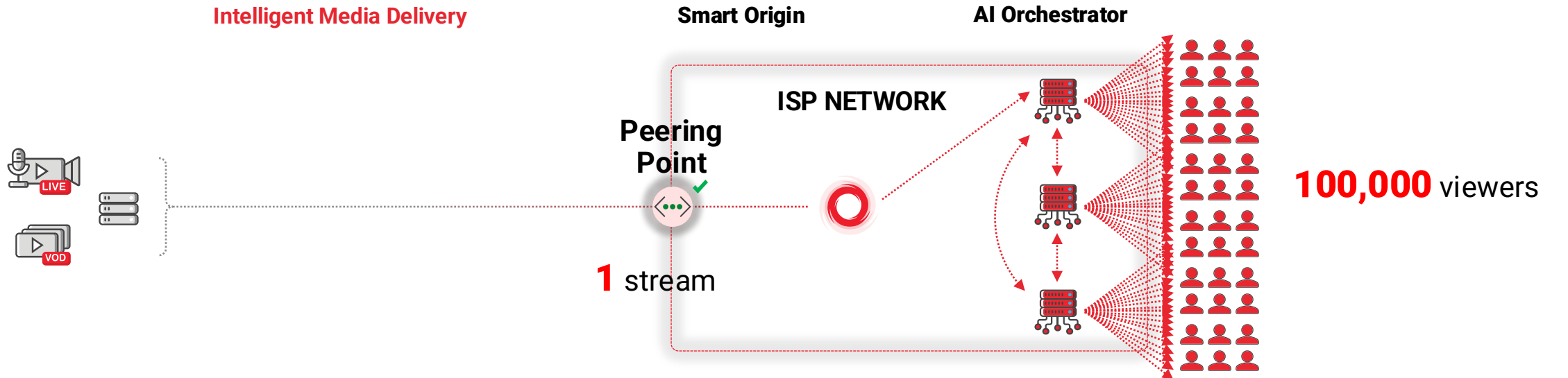
Creating a Private Edge Network is the solution...



The Edge Advantage



Intelligent Media Delivery



| Why Invest in private EDGE now?



Broadcast moves to Streaming

Available **capacity** is shrinking



New services require low latency

Real time interactivity and VR



Smarter distribution is required

Less overhead and video centric delivery



ISPs need to pivot their business model

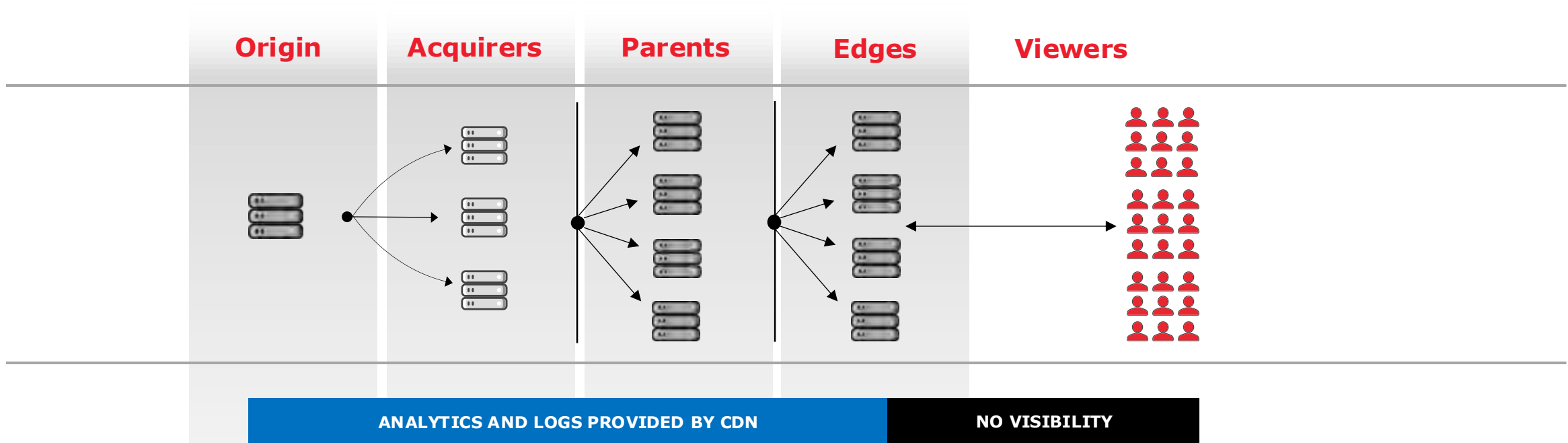
Value add **Edge applications**



CMCD+



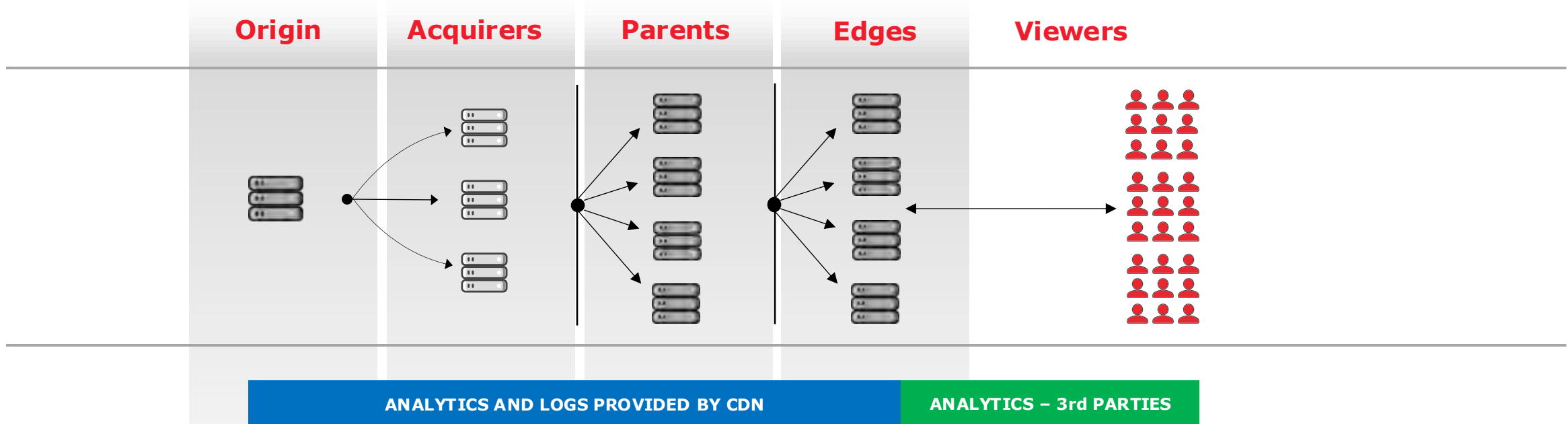
CDN Analytics and Logs – Legacy CDN



- 1) Standard CDN Analytics cover the delivery chain from Origin up to Edge
- 2) Edge to Viewers (ISP, Last Mile) -> no visibility



CDN Analytics and Logs – Legacy CDN + 3rd Parties Analytics

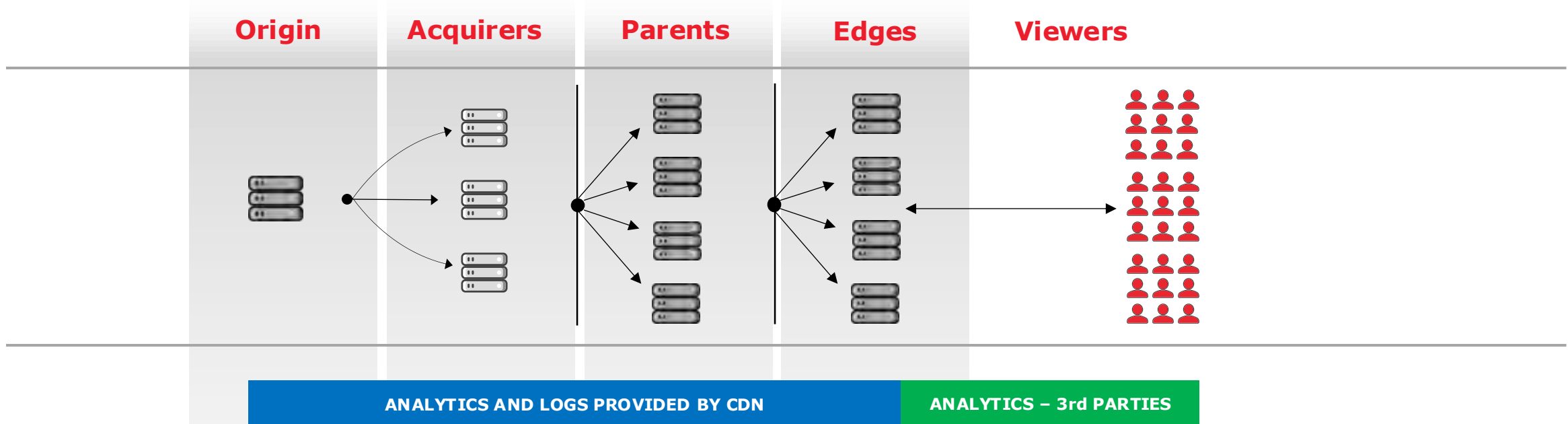


- 1) CDN Analytics and Logs cover the delivery chain from Origin to Edge
- 2) Third parties services cover Edge to Viewers, via their custom player plugin, sending metric to their own analytics portals.

Two separate analytics and logs Portals : not handy for in depth analysis on the whole delivery chain / expensive as you have to pay highly priced 3rd parties services



CDN Analytics and Logs – Legacy CDN + 3rd Parties Analytics



We want to unify the analytics and log service with visibility from Origin to Viewers.

How can we reach that goal?

Introducing a standard in the communication between player and CDN, making it available to the community, so that CDNs can finally ingest users side metric and extend their analytics and log reach.



Common Media Client Data

Web Application Video Ecosystem

CTA – Consumer Technology Association

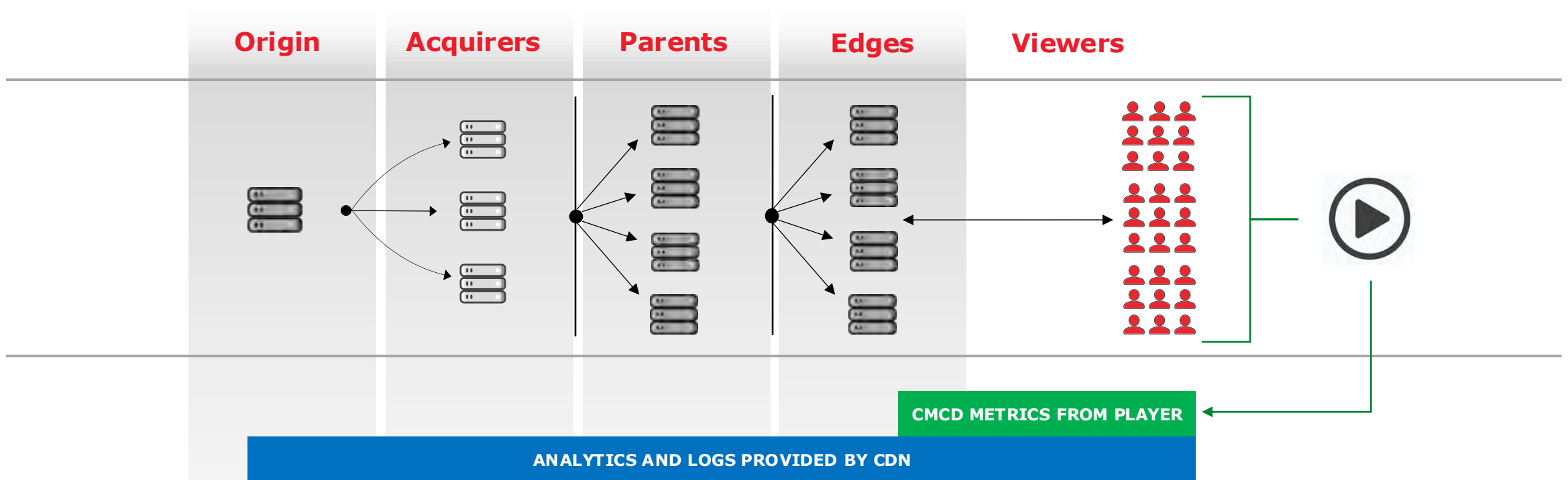
Providing a **standard for the communication** of client-side Quality of Experience (QoE) metrics between media players and CDNs during video streaming sessions.

CDNs can merge CMCD Edge-to-Viewer QoE metrics ingested from the players with their internal Origin-to-Edge QOS metrics

The results is a **full view over the whole streaming process, from Origin to Viewers, last mile included.**



CDN Analytics and Logs – CMCD CDN



CMCD

- **Encoded Bitrate** int kbps Encoded bitrate of the audio or video object being requested.
- **Buffer Length** int ms Buffer length associated with the media object being requested.
- **Buffer Starvation** boolean Buffer was starved (rebuffering)
- Content ID string Unique string identifying the current content
- Object Duration int ms Playback duration in milliseconds of the object being requested
- Deadline int ms Deadline from request time until first sample to avoid rebuffering
- **Measured Throughput** int ms Throughput between client and server, as measured by client
- **Next Object Request** string Relative path of next object to be requested (*pre-fetching*)
- **Next Range Request** string Byte range to be requested, for partial object requests (*pre-fetching*)
- Object Type token Media type of object requested (m=text; av=muxed audio video; ..)
- Playback Rate decimal 1=realtime ; 2=double speed ; 0=not playing
- **Requested Maximum Throughput** int kbps Requested max throughput clients considers enough for asset delivery
- Streaming Format token d=dash; h=hls; s=smooth streaming; o = other
- Session ID string GUID identifying the current playback session
- Stream Type token v=all segments available (VOD); l=segment available over time (Live)
- **Startup** boolean Object needed urgently due to startup, seeking or rebuffer recovery
- Top Bitrate int kbps Highest bitrate rendition in manifest of playlist client allowed to play
- CMCD Version int CMCD Version (1 if omitted)



| CMCD v2

NOR and NRR can now support multiple object prefetch

lrc – live stream latency

tbl – target buffer length

mst – media start time

ab – aggregate encoded bitrate

tab - top aggregated encoded bitrate

bsd – buffer starvation duration

rc – response code

- ttfb – time to first byte

- ttfbb – time to first body byte

- ttlb – time to last byte

- ts – timestamp

- url – request URL.

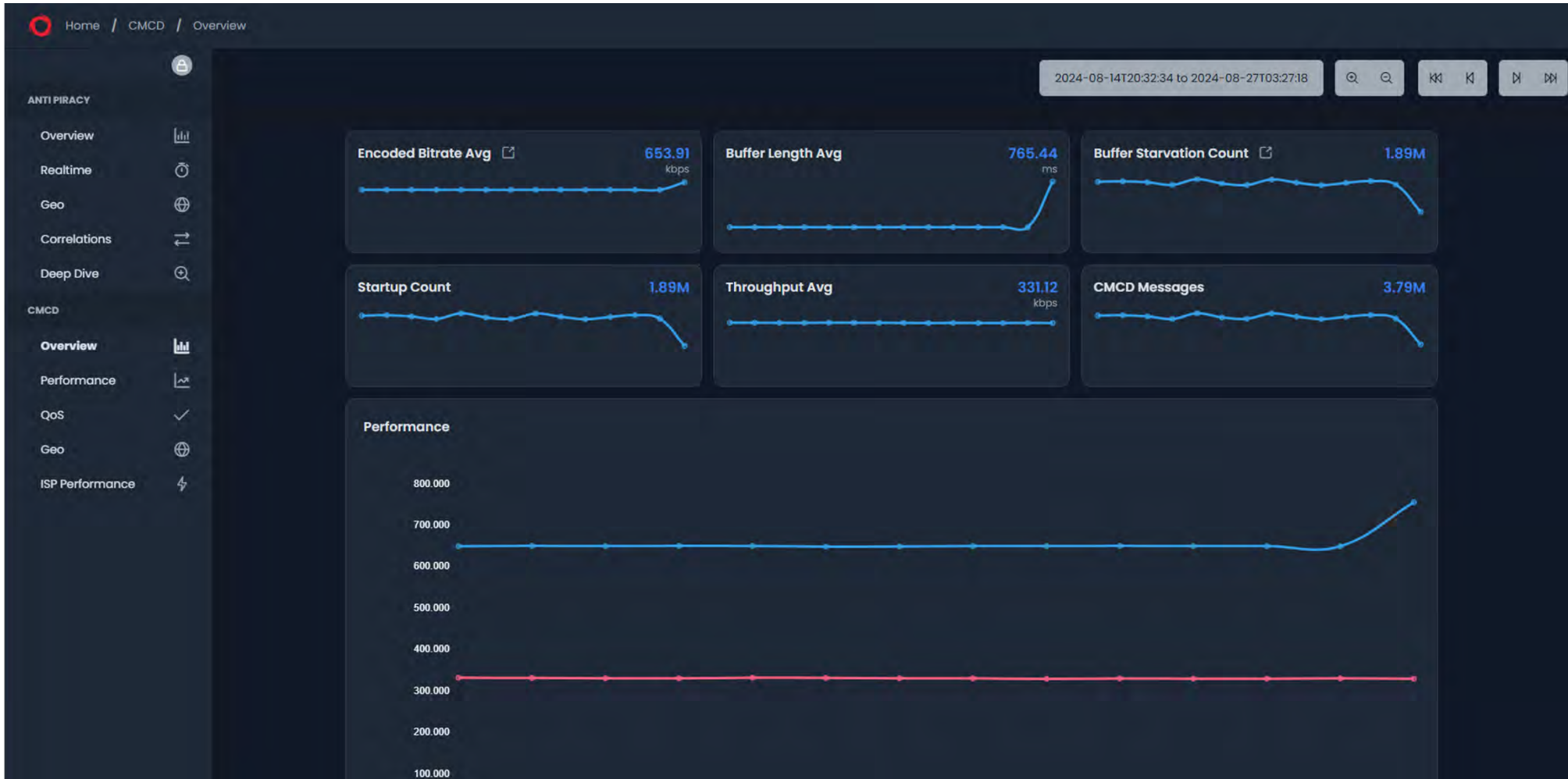
- sta – player state (start | playing | seeking | rebuffering | paused | end | fatal error)

- v – must be reported for $v \geq 2$.

multiple reporting modes > sending data to third parties



CMCD Analytics - Overview



Overview

Performance

QoS

Geo

ISP

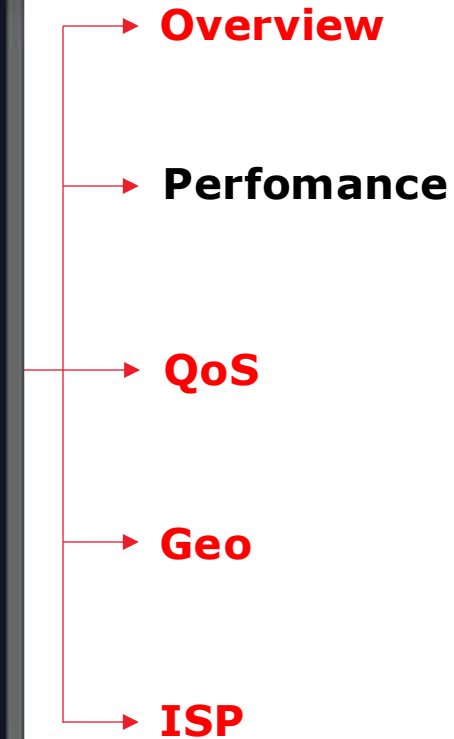
General Metrics (player side):

- Encoded Bitrate Average
- Buffer length Average – Buffer Starvation Count
- Network Throughput Average
- Startup Count – CMCD messages received

- Performance Graph
 - Throughput Average
 - Bitrate Average



CMCD Analytics - Performance

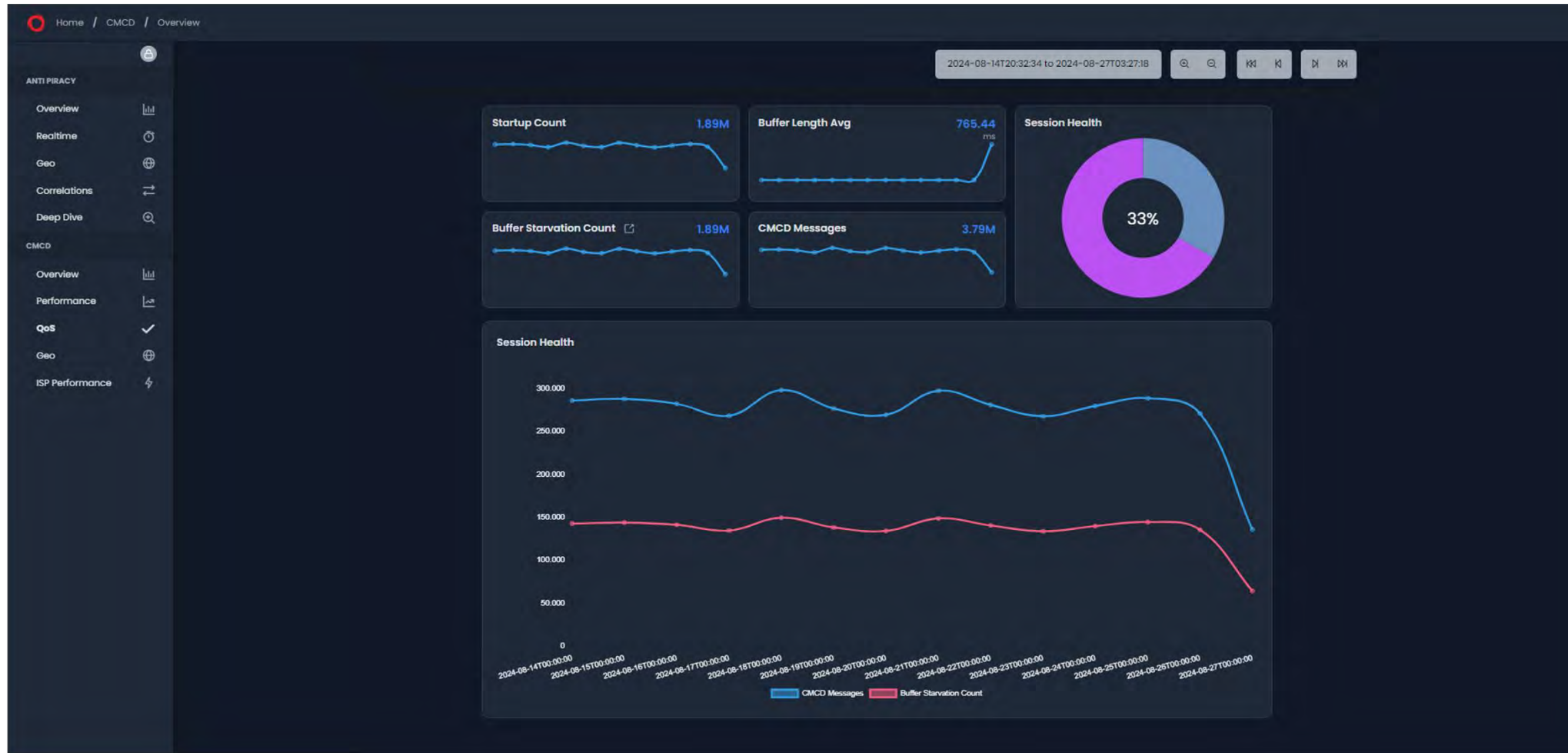


Performance Metrics (player side):

- Encoded Bitrate Average
 - Network Throughput Average
 - CMCD messages received
- Performance graph
 - Throughput avg
 - Bitrate avg



CMCD Analytics - QoS



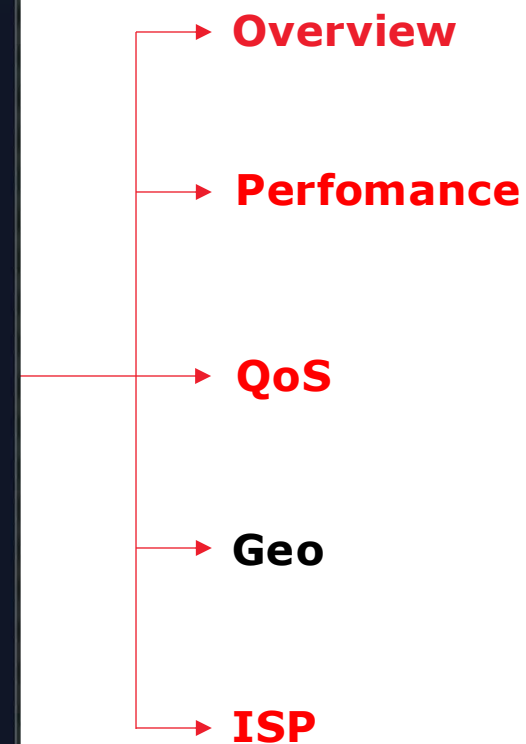
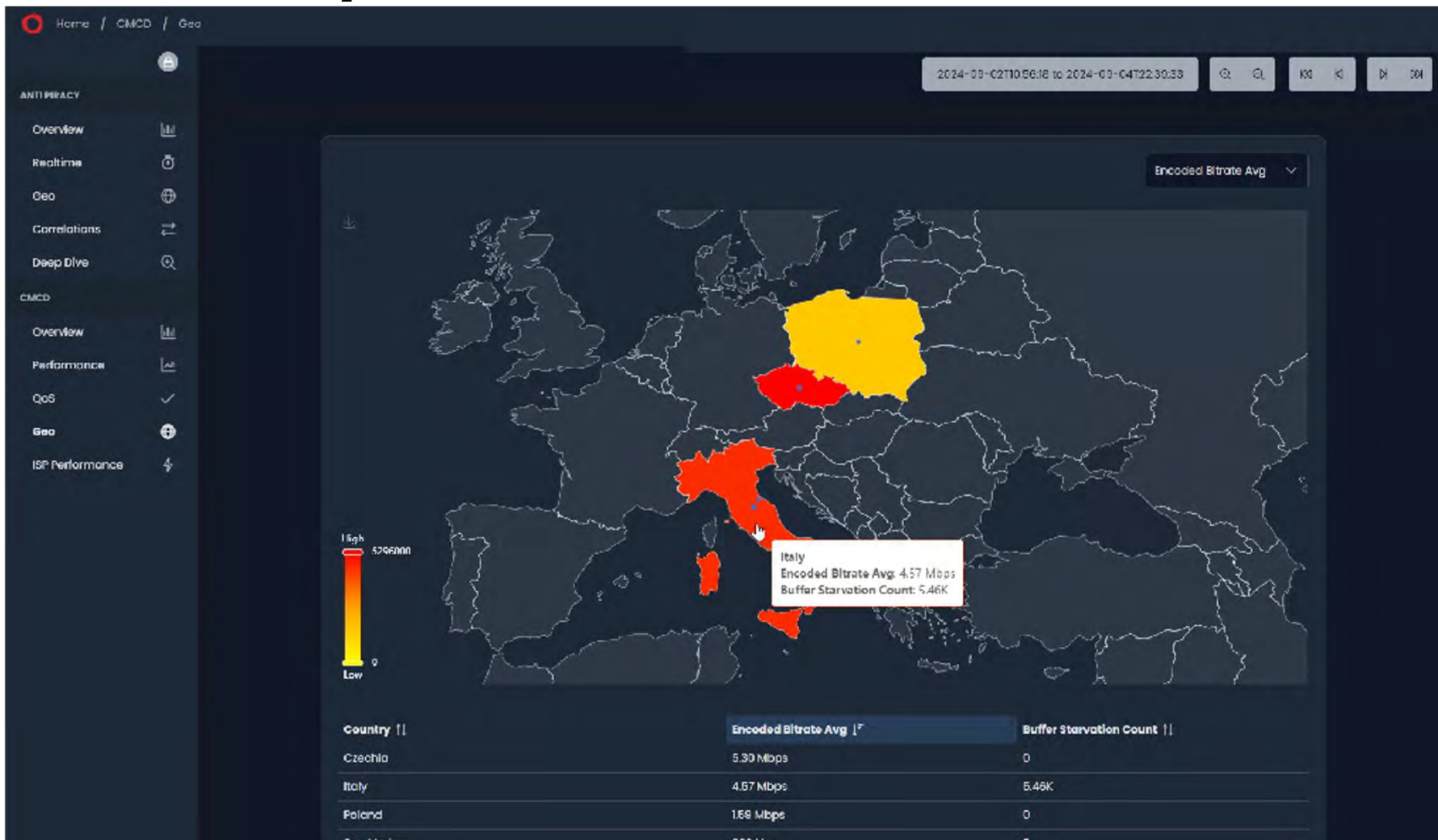
- Overview
- Performance
- QoS
- Geo
- ISP

Key QoS metrics, including session startup and buffer starvation counters, which help determine the percentage of healthy sessions.

You can also filter and combine player-reported CMCD data with internal CDN metrics. Since the CDN alone can't show why the player stops or its buffer status, CMCD is key to gaining a full picture of QoS.



CMCD Analytics - Geo

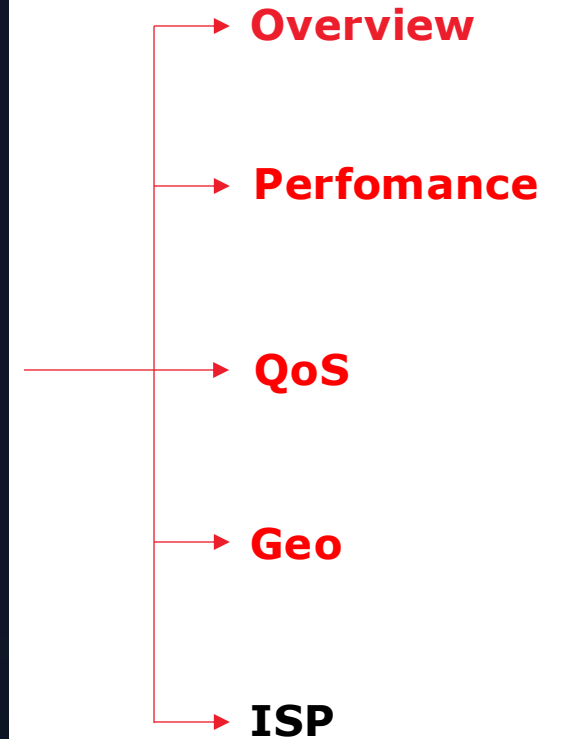
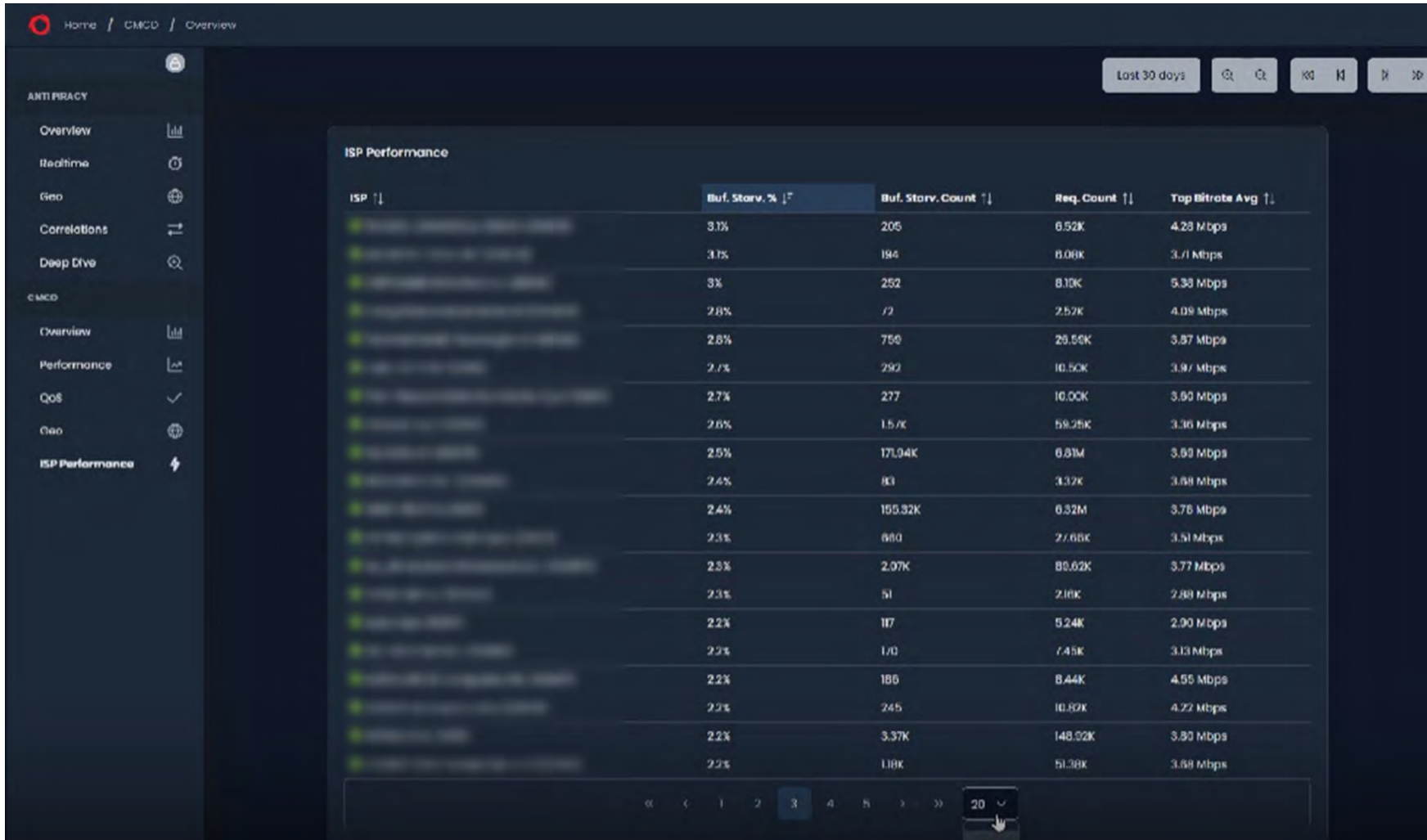


Geo Distribution – Performance by country, highlighting differences in network conditions, playback quality, and user experience across regions.

You can choose different metrics to draw on map. For example bitrate, or buffer starvation events.



CMCD Analytics - ISP



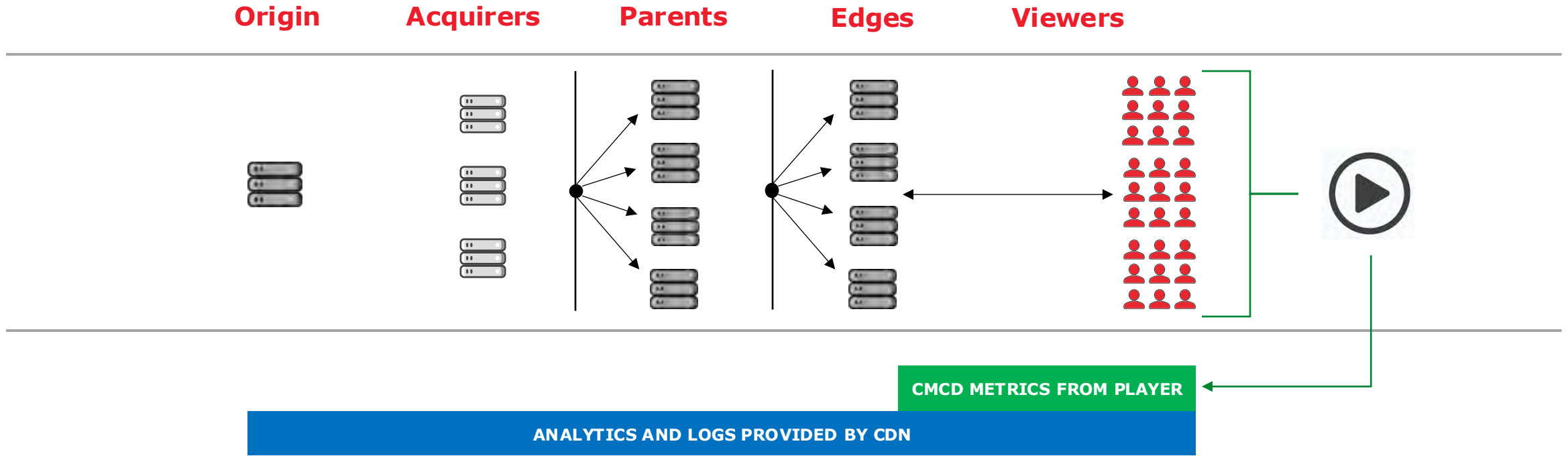
QoS Distribution by ISP – Shows performance across ISPs. This aims to improve QoS and deliver the best quality where possible, as grouping only by country or region may not provide a complete view.



CMCD | Prefetching



CMCD Prefetching



CMCD+ CDN

Get the best video quality from CDN

CMCD messages **nor** or **nrr** (next object request, next range request) trigger the CDN to download the next slice in advance, thus reducing latency even for "cold" content.

CMCD enabled player

Get the best video quality from the player

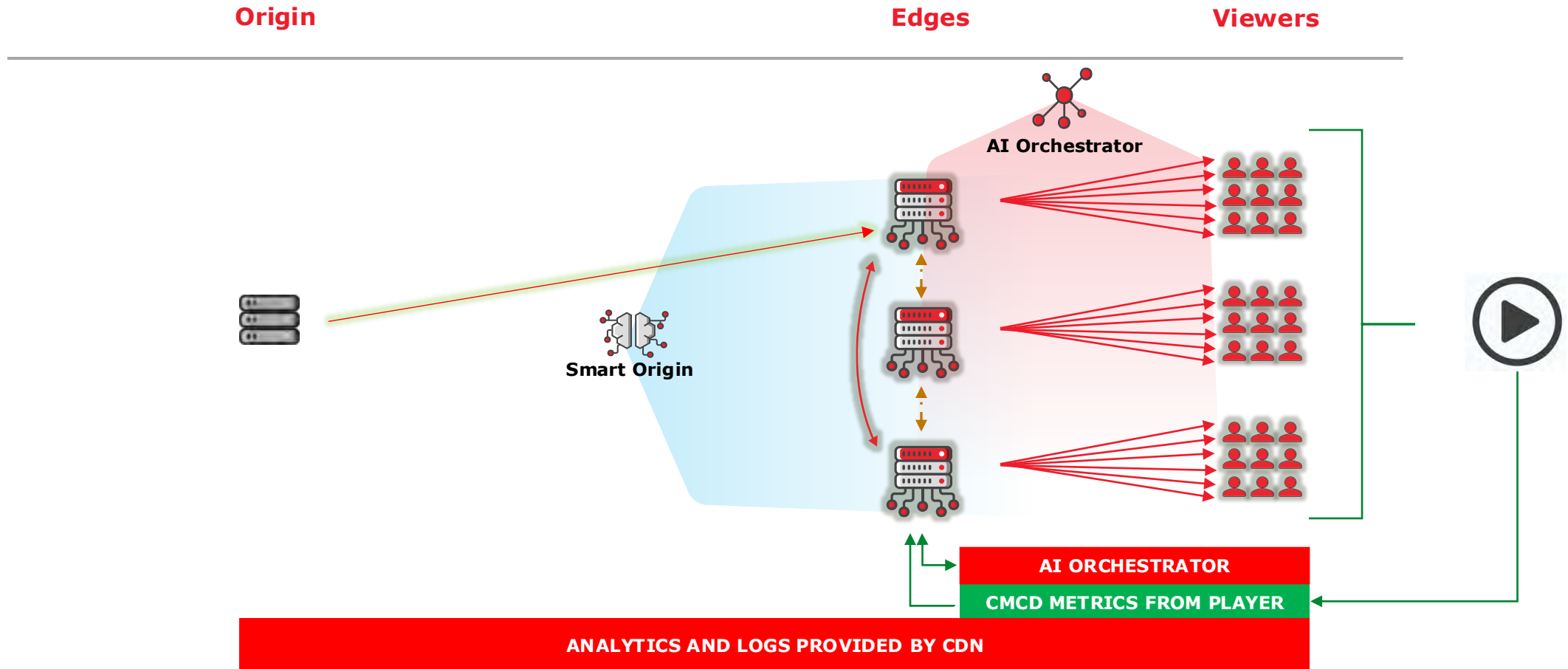
Send CDN **nor** or **nrr** prefetching requests to improve QoE.



Leveraging CMCD | CMCD+ Edge CDN with AI Orchestrator



CDN Analytics and Logs - CMCD Edge CDN w/ AI Orchestrator

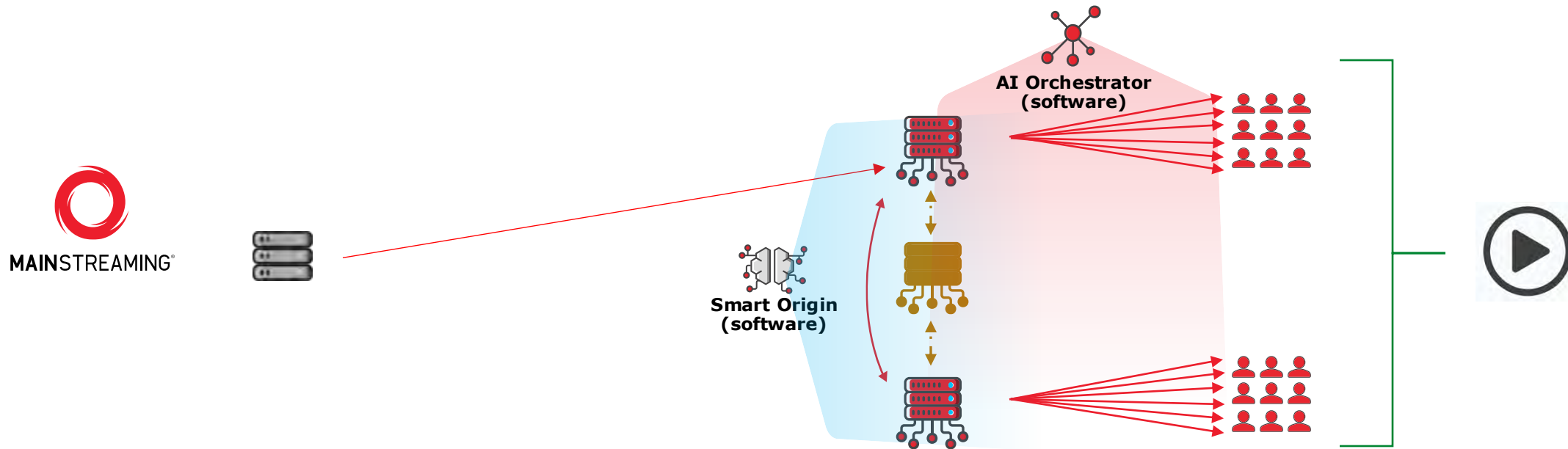


CMCD+ AI Orchestrator Integration

Origin

Edges

Audience



Smart Origin

Get the best video quality from the Origin server

Contents are requested just once from Origin servers, avoiding rebuffering and streaming errors while protecting the Origin from overload and minimizing network traffic

AI Orchestrator

Define network path based on KPI feedback loops

Advanced viewers location detection, Edge server and Network utilization metrics are on-the-fly analyzed to land each viewer to their best/closest EDGE server, granting broadcast-grade QoE
CMCD metrics added to the mix to drive AI Orchestrator intelligence



Anti-Piracy



Originator

Where's the request coming from?

- Risky ASN
- Cloud Providers
- CDN Provider
- Proxy
- VPN
- BOTNET
- Tor Node
- Tor Exit Node
- ...[future]...

NAME DOMAIN SCRIPTING

STAGING PRODUCTION CLONE RENAME DELETE SAVE

Rules

Duplicated rules are not allowed. Priority order is from top to down.

Active	Originator	Threat	Action	
<input checked="" type="checkbox"/>	Risky ASN	ISD (Illegal Streaming Device)	Allow	→ ↓ ✖
<input checked="" type="checkbox"/>	Any	ISD (Illegal Streaming Device)	Block	↑ ↓ ✖
<input type="checkbox"/>	Risky ASN	CDN Leeching	Allow	↑ + ✖

ADD RULE



Threat & Action

Threat

- Any
- Illegal streaming device
- Bulk Downloader
- Token Sharing
- Deep Linking
- CDN Leeching
- ...[future]...

Action

- Allow
- Limit Throughput
- Alter Video/Audio
- Block
- ...[future]...

NAME DOMAIN SCRIPTING

STAGING PRODUCTION CLONE RENAME DELETE SAVE

Rules

Duplicated rules are not allowed. Priority order is from top to down.

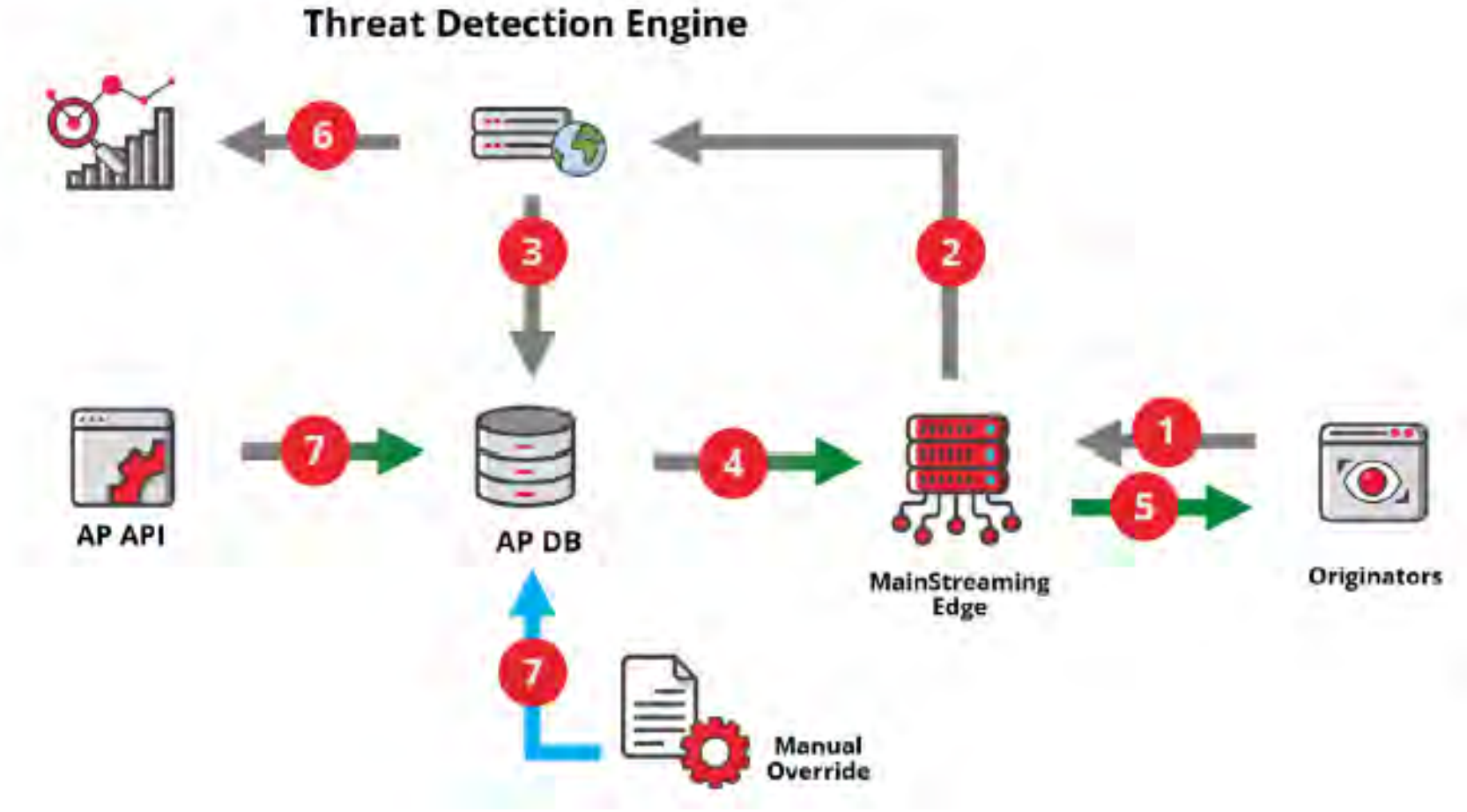
Active	Originator	Threat	Action
<input checked="" type="checkbox"/>	Risky ASN	ISD (Illegal Streaming Device)	Allow
<input checked="" type="checkbox"/>	Cloud Provider	ISD (Illegal Streaming Device)	Block
<input type="checkbox"/>	TOR Node	CDN Leeching	Allow

ADD RULE

- Allow
- Limit Throughput
- Alter Video/Audio
- Block



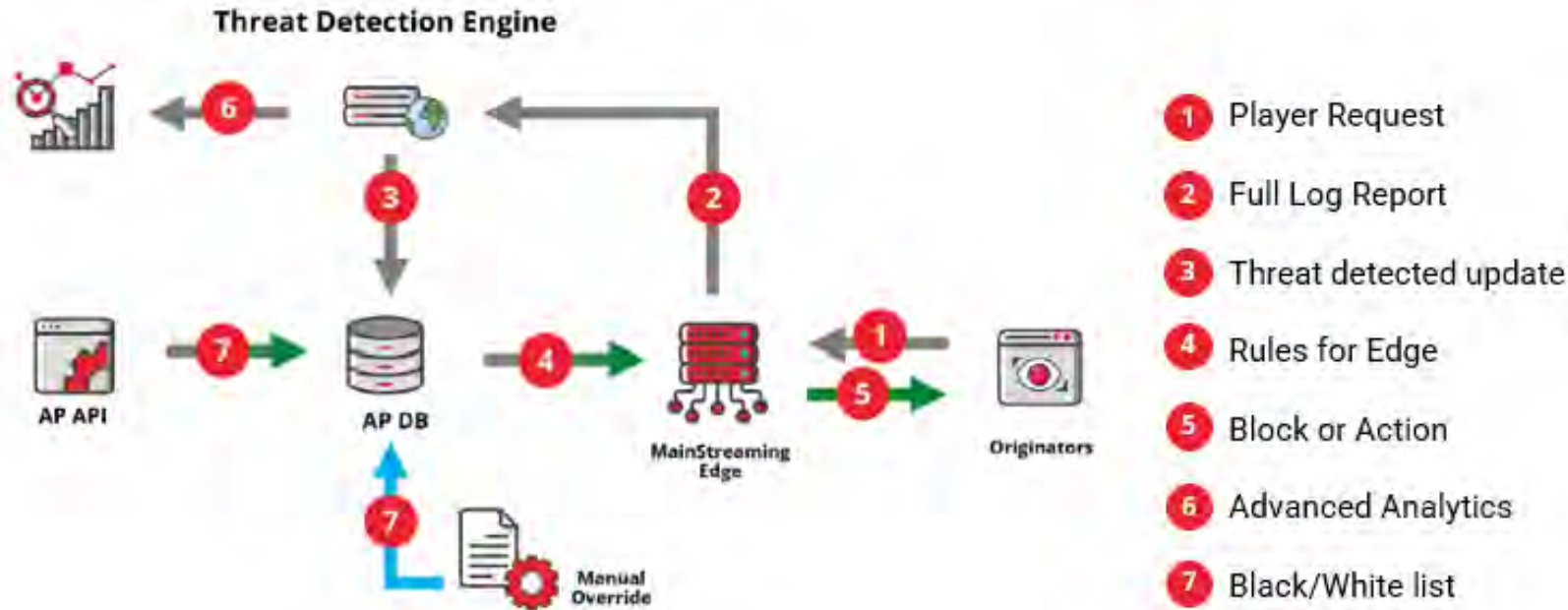
Our Anti-Piracy solution. Far beyond VPN and Proxy tracking tools



- 1 Player Request
- 2 Full Log Report
- 3 Threat detected update
- 4 Rules for Edge
- 5 Block or Action
- 6 Advanced Analytics
- 7 Black/White list



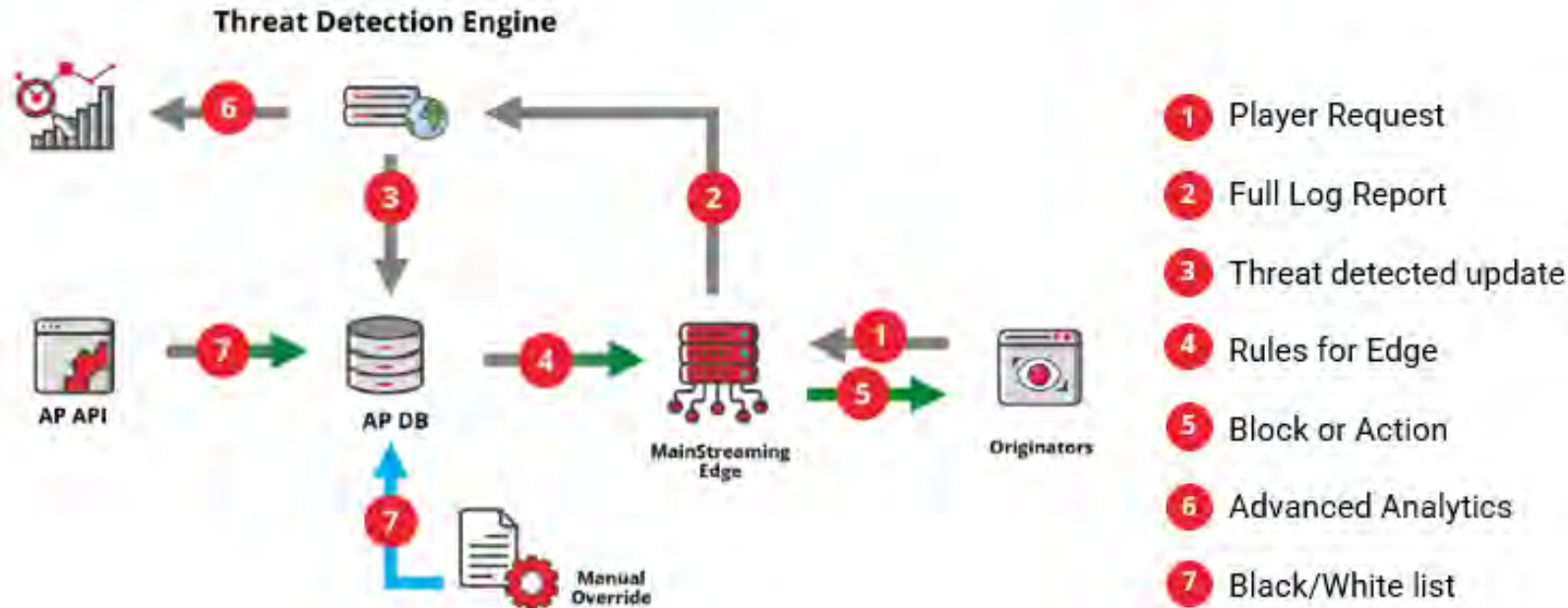
| Not a simple VPN and Proxy blocker



Advanced detection system utilizes sophisticated algorithms and machine learning to identify patterns of abnormal content consumption, flagging potential instances of piracy or threats with high precision. System is designed to be adaptable, capable of evolving to fight piracy tactics emerging in the future.



Control via GUI or Integrate via API

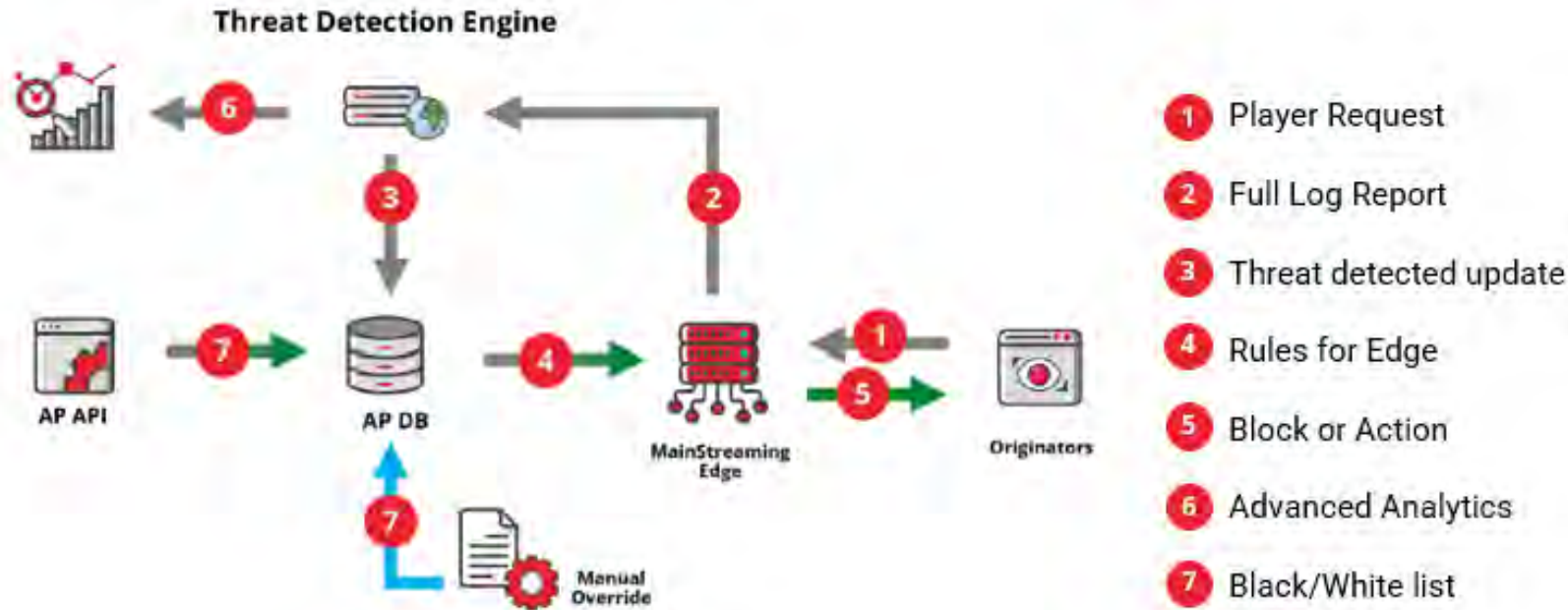


Dynamic IP Management through Queue mechanisms and API Integration

- **Real-time IP updates:** customers can subscribe to a queue to receive continuous updates on IP addresses that should be blocked.
- **API for IP management:** we provide an API for customers to manage their IP lists, allowing them to easily whitelist or blacklist addresses.
- **Enhanced security:** this solution ensures customers have full control over their network access policies, enhancing their anti-piracy protection.



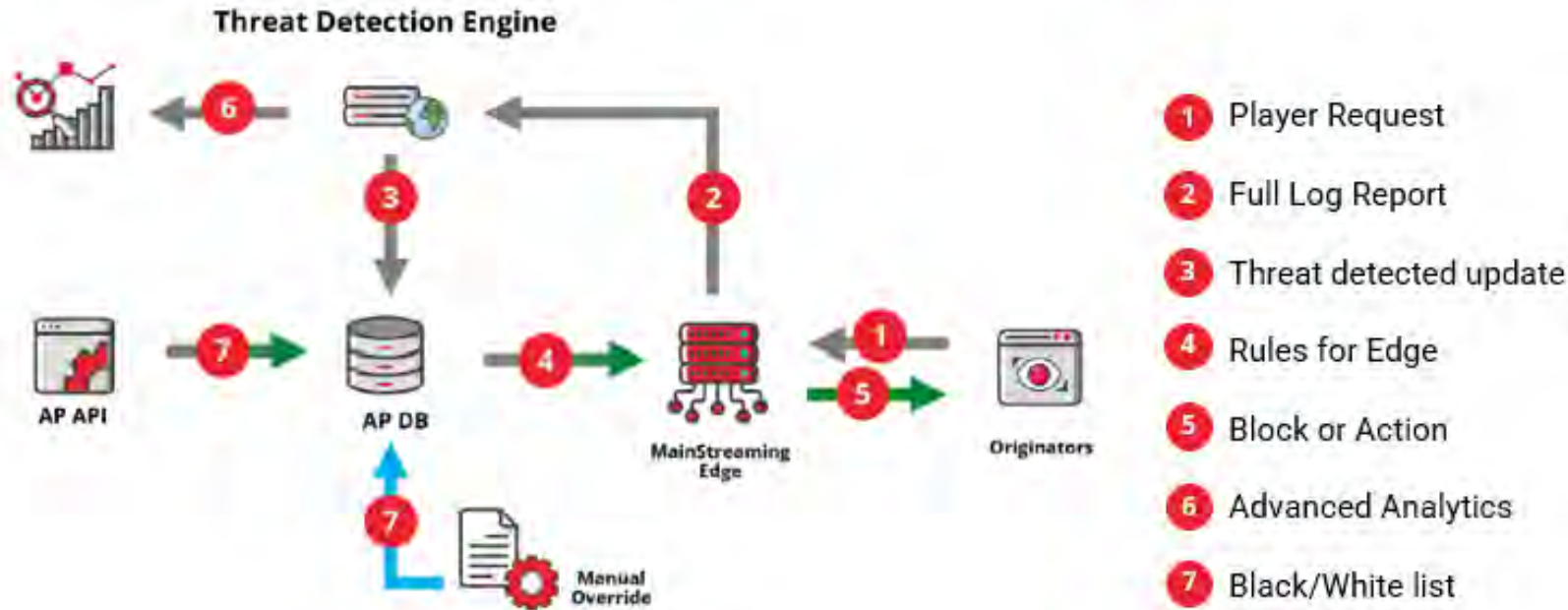
Extensive Dataset for training the engine



Our **Threat Detection Engine** benefits from insights gathered across **vast and varied sources**: it's trained by anonymized patterns observed on our extensive infrastructure, enhancing security without relying on any individual customer's data.



| Track and Observe, or Act



Our **Anti-Piracy tool** can be instructed to **provide a report** of the ongoing threats, without any reaction, or to **provide both a report and a reaction**. The reaction can be customized and tailored on categories of origins + threats.



Anti-Piracy Analytics

Anti Piracy / Overview

20/06/2024 03:36 - 22/06/2024 03:36 Apply

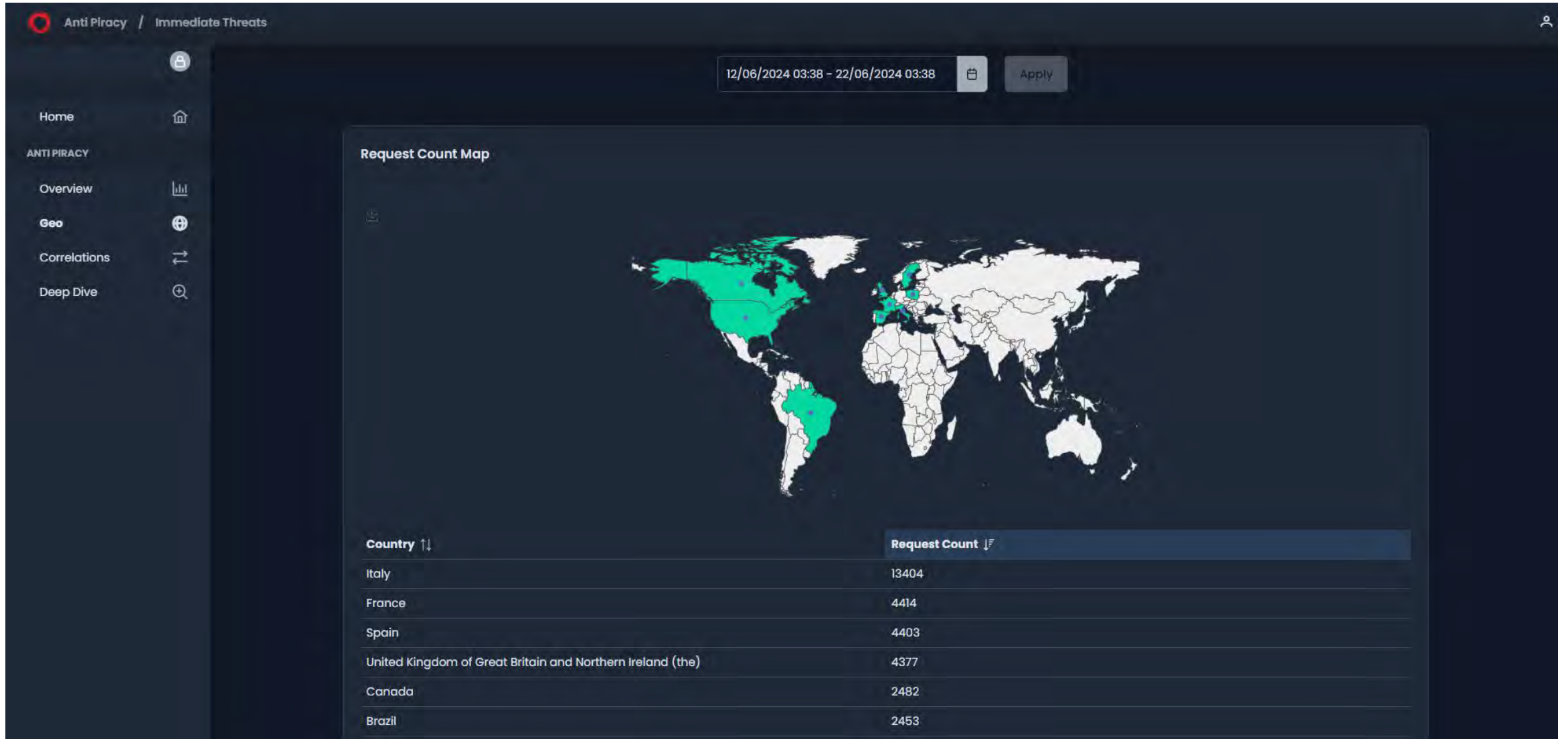
Originator ↑↓	Threat ↑↓	Action ↑↓	Requests ↓
None	ISD (Illegal Streaming Device)	Allow	79
None	ISD (Illegal Streaming Device)	Alter Video/Audio	64
None	Bulk Downloader	N/A - 0	61
None	Deep Linking	Allow	57
None	CDN Leeching	Allow	57
CDN Provider	Bulk Downloader	Alter Video/Audio	57
Proxy	ISD (Illegal Streaming Device)	N/A - 0	57
None	Deep Linking	N/A - 0	56
None	Deep Linking	Limit Throughput	56
None	CDN Leeching	Limit Throughput	56
None	Bulk Downloader	Alter Video/Audio	55
Risky ASN	ISD (Illegal Streaming Device)	Allow	55
Risky ASN	Bulk Downloader	Alter Video/Audio	55
CDN Provider	CDN Leeching	Alter Video/Audio	55
BOTNET	CDN Leeching	Allow	55
Risky ASN	Deep Linking	Limit Throughput	54
Risky ASN	CDN Leeching	Allow	54
Cloud Provider	None	Limit Throughput	54
VPN	ISD (Illegal Streaming Device)	Limit Throughput	54
TOR Node	Deep Linking	Limit Throughput	54



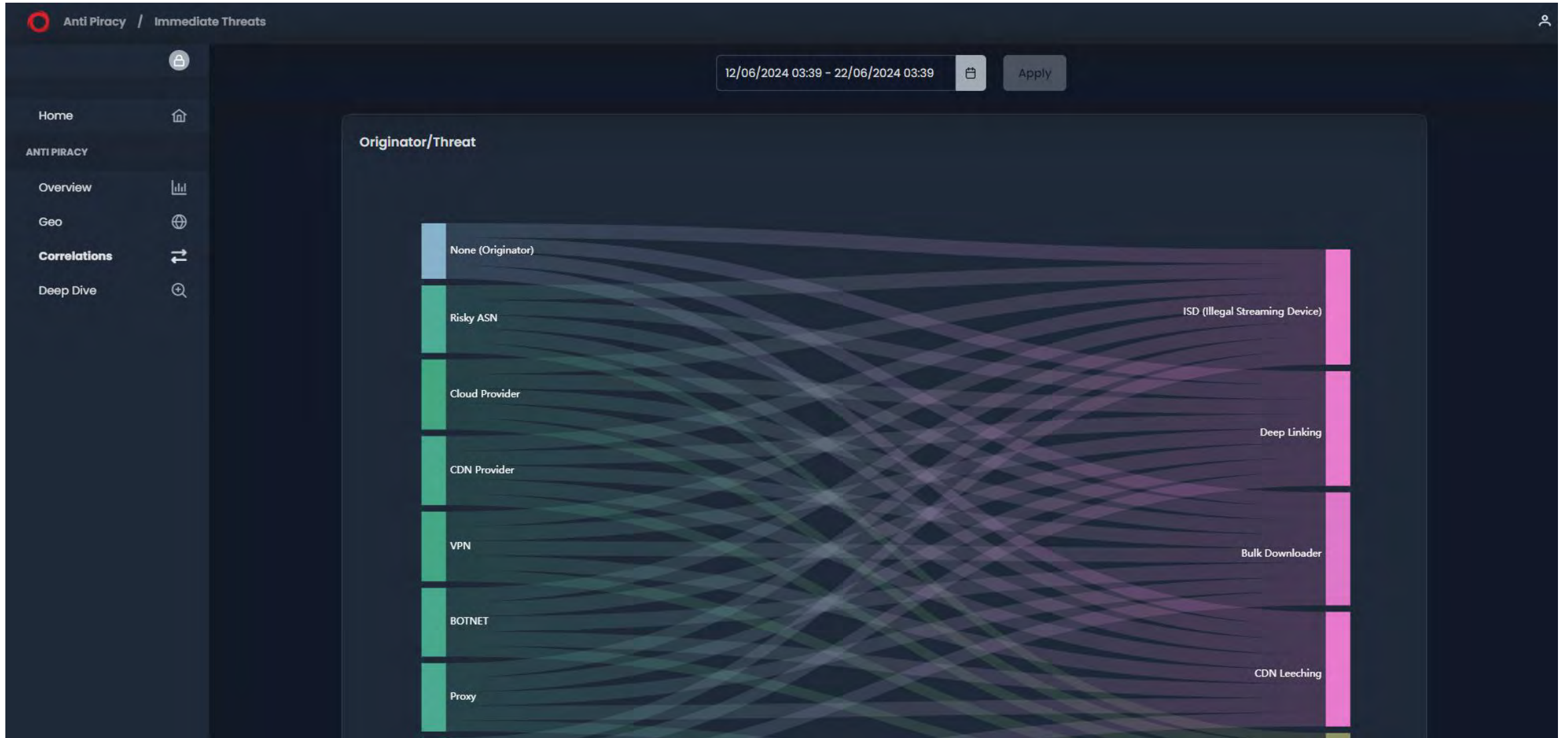
Anti-Piracy Analytics



Anti-Piracy Analytics



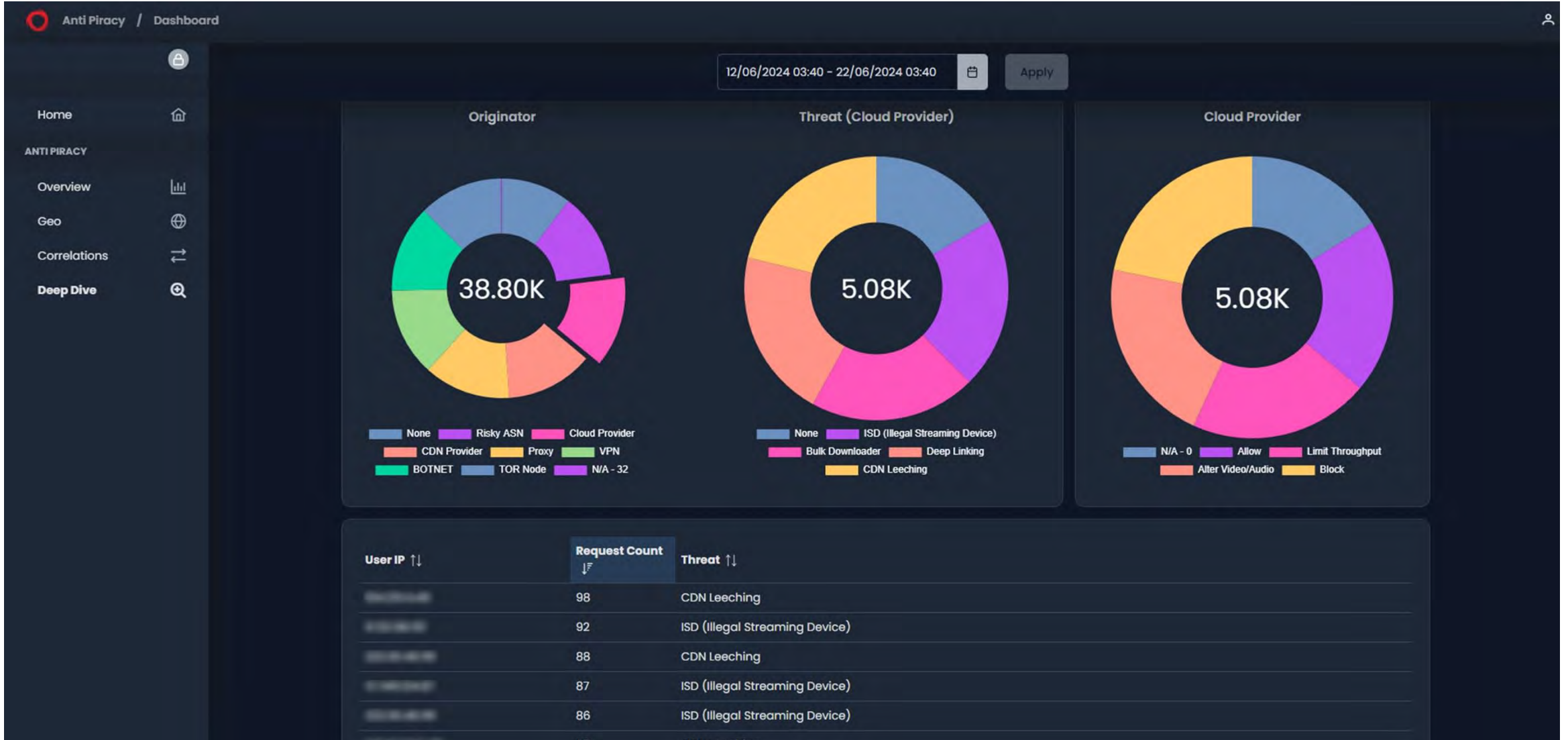
Anti-Piracy Analytics



Anti-Piracy Analytics



Anti-Piracy Analytics



Q&A Time





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Thank you!

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