



Compira Labs

Solving Quality of Experience for the Last Mile

QoE in adaptive video streaming

OTT streaming services are experiencing explosive growth. Hundreds of millions of people worldwide have already subscribed to one or more streaming services. Unlike traditional Pay TV services, subscribers expect to be able to consume streaming services on any device, including TV, cell phone, PC, tablet, and in any location (home, office, on the way to and from work, etc.). While content is definitely 'king', delivering premium quality is a close second, and is a major concern for streaming service providers. The key metrics that affect users' Quality of Experience (QoE) in adaptive video streaming are:

- › **Video re-buffering ratio** – The fraction of time a viewer experiences re-buffering issues (i.e. the video stops playing)
- › **End-to-end latency** – For live events, this is the accumulated delay from the time a scene has been captured by a camera and until it is presented on the screen of a client device. Also referred to as glass-to-glass latency.
- › **Video startup time** – the time from the initiation of 'play' until video actually starts playing on the client's screen.
- › **Average streaming bit-rate** – the media bit rate, averaged over the entire streaming period. In the context of ABR, this is the average of all the segment frame resolutions selected by the client during playback (out of the available encoding ladder).

Content Distribution Networks (CDNs)

As QoE metrics are highly sensitive to the proximity of the video asset to the client requesting it, OTT streaming providers employ Content Distribution Networks (CDNs). CDNs distribute the ABR video content received from the origin servers to the edges of their networks and cache the ABR segments there, so that video clients can receive the requested content from the closest available cache. This is intended to yield low latency and startup time.

The 'last-mile' challenge

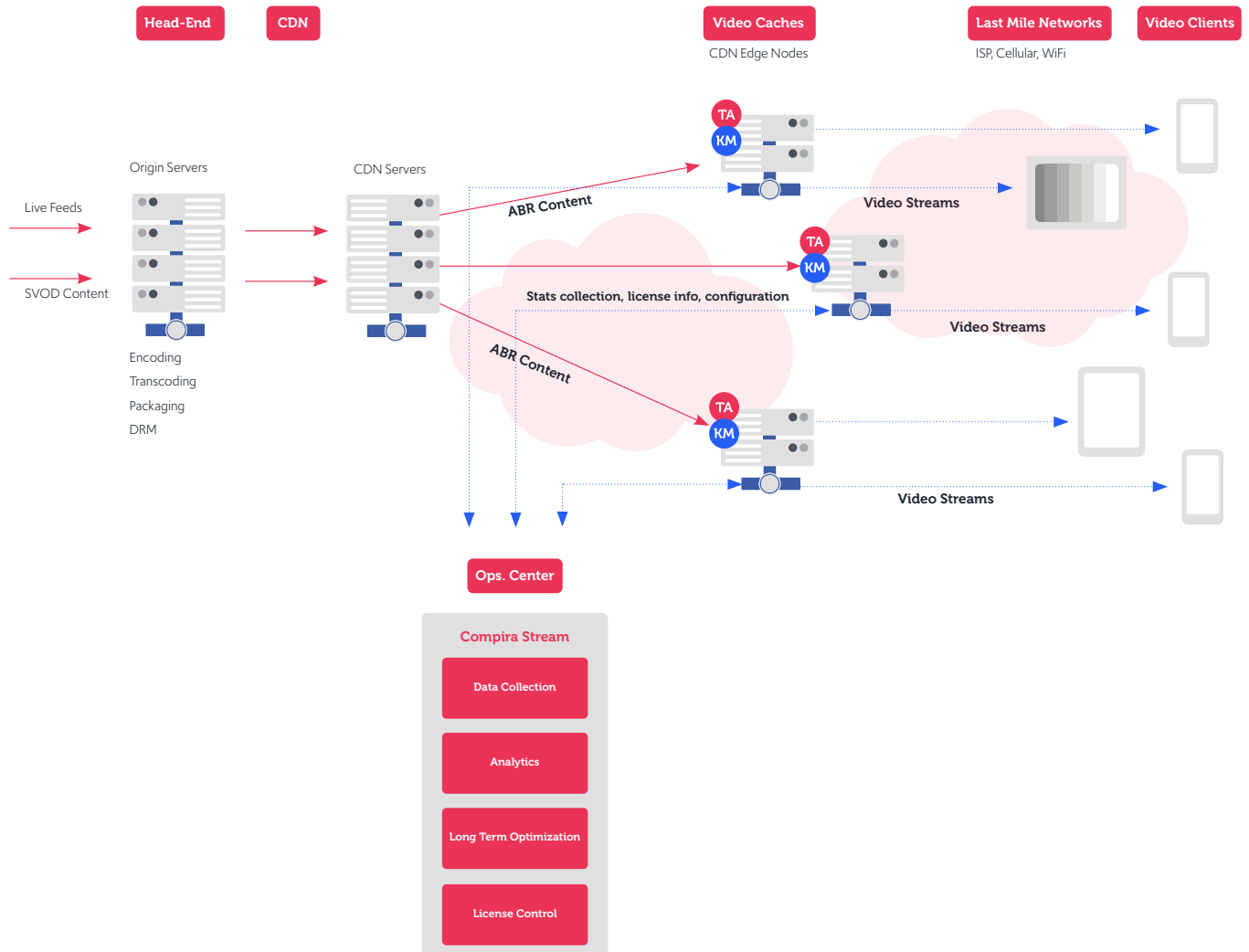
Delivering an ABR stream from the edge of the CDN to video clients installed on end-devices, i.e. across the 'last-mile' network, is the most challenging delivery stage in terms of QoE, as last mile network conditions are often volatile and highly dynamic:

- › **Different technologies** – Clients are connected using DSL, Cable, cellular and Wi-Fi technologies that exhibit different characteristics in terms of available bandwidth, stability, delay and jitter
- › **Congestion on ISP and residential networks** – IP packets carrying video streams can be delayed or even discarded

Due to fluctuating network bandwidth on the 'last-mile', ABR clients often select low video frame resolutions and sometimes buffer up to 30 seconds of video (3 full ABR segments) before starting playback. This can reduce the re-buffering ratio but increases end-to-end latency to levels that are not acceptable for live events, such as sports or esports. The root-cause for this sub-optimal video QoE in the last-mile are the deficiencies of the transport layer congestion-control (TCP in the case of HTTP based streaming).

Our solution

Compira Labs provides a software solution that dramatically improves QoE in 'last-mile' delivery. By upgrading the network stack at the CDN edge nodes, Compira's next-generation congestion-control technology maximizes media delivery rates and reduces re-buffering ratio and latency. Data collection and analytics engines provide visibility into QoE metrics across the network, and machine-learning-based intelligence enables continuous performance optimization.



Solution components

- > **Kernel Module (KM)** – Loadable Linux kernel module provides real-time streaming optimization via next-generation congestion-control technology.
- > **Thin Agent (TA)** – User-space agent for data-collection and remote kernel-module configuration.
- > **Compira Stream (CS)** – A central web application that activates, configures, and collects data from all agents and modules. Provides performance analytics and non-real-time optimization.

Benefits

- > **Significantly better QoE** – 30% increase in HD sessions and 30% - 40% reduction in rebuffering ratio are typical gains in QoE metrics for fixed network as well as mobile users.
- > **Visibility** – See into real-time and historical performance data at node, subnet and IP address granularity.
- > **Seamless upgrade** – Transparent to video clients, video applications, and the network. Encoding and format (HLS, MPEG-DASH) agnostic.
- > **Customizable** – Per content type (e.g. SVoD, Live), deployment scenario and QoE goals.