

WHITE PAPER

Delivering Live Video from the Cloud When the World is Watching

Ensure Streaming Video Quality at Scale
Through Every Phase of the Workflow



Big Live TV events are exciting. They drive nearly 10 times more viewer engagement than on-demand video¹. So it's no surprise that programmers have embraced live TV and major events through the Internet. In the United States, a live version of the U.K.'s long-running Ant & Dec's Saturday Night Takeaway just premiered along with National Geographic's "Brain Surgery Live", and the BBC's iPlayer has long shown a live simulcast of major events on its channels.

Great productions demand great Quality of Experience (QoE) if you expect to ensure loyalty during your live video transmission. In today's fickle online environment, audiences expect a TV-like video experience on any device, especially when they're watching a live event or linear TV online. No buffering. No failure. HD (or better) video quality. A recent study by the University of Massachusetts representing 23 million online video streams showed that over 5% of users abandon sports streams when rebuffering lasts a mere two seconds per minute of content. Abandonment rates increase dramatically thereafter.

These figures show that the hours of creative planning to deliver fantastic quality live video can be wasted without consistent, high-quality streams with no buffering.

Quality matters, but despite advances made in video streaming technology, delivering great quality live video over the Internet is still not easy. There are challenges with predicting the scale and potential audience location; challenges with managing complex encoder and origin technology; challenges of delivering video securely and reliably over the Internet; and challenges of protecting live streams. Add to that the range of devices, the complexity of live event production, and the demand for HD and 4K image quality and you get a scenario that is more complicated than ever before.

Ensuring Video Quality at Every Step in the Live Workflow

At Akamai, we've learned what keeps digital viewers loyal. With over 17 years of experience in delivering live video to some of the largest audiences on the Internet, we've identified where the challenges lie from start to finish. This paper provides a view of the key challenges for online video streaming and how Akamai and our customers have developed means to address them.

Experience has taught us the key to success is to think about video quality at every step of the workflow, whether your event is global or local. From integrating production technology and establishing a robust streaming video infrastructure to repackaging content for the complex device landscape, many pieces have to come together in perfect synchronization. These are our recommendations for success.



1. Build in Quality During Planning

Delivering great live video online requires quality to be part of the process before the first byte is ever streamed. This is true whether your event is a massive undertaking like the Olympics or FIFA World Cup or a new concert series that's just starting to grow an audience. Here are four questions that can help make your planning successful:

- Capacity: What audience scale will the event drive?
- Complexity: What devices will audiences use?
- Calendar: Where and when will traffic be heavy?
- Catastrophe: What happens if something goes wrong?

How can you go about this? When Akamai works with Turner Broadcasting (NCAA college basketball tournament), NBC (the Olympics), or FIFA (the World Cup), our teams begin collaborating months in advance of the event. Among the steps you can take:

- Connect your production team with your video delivery partner's solution specialists early, and review every step of the process. The teams should build a detailed picture of the required workflow, from camera to viewer.
- Every live video is unique, so expect to develop custom plans that cover origin and delivery resilience, encoder profiles, video stream security, and capacity planning.

Make sure the teams jointly detail service, support, and escalation procedures for each step of the process. Fingers should not be pointing if a problem arises.

2. Ensure Quality at Ingest/Acquisition

If you can't get a high-quality video stream to the cloud, you can't deliver a high-quality viewing experience. Quality starts at ingest, and it's here where a significant number of errors can occur that impact the viewer's experience. A typical error might be live stream entry-point failure. Its impact? Live streams stuttering or even worse – complete failure.

Here are six things you can look for from your video delivery partner to minimize opportunities for error and maximize quality at ingest:

- Ensure live-stream ingest points are close to your encoders. The proximity of ingest points in relation to your encoders can ensure a higher quality video stream. Put simply, your live streams don't have to traverse multiple networks before they are ingested.
- Make sure those ingest points are resilient. It's rare, but entry points can fail. More often, they can underperform. Ask your partner how they handle this. Akamai, for example, dynamically and automatically remaps live-event video streams to an optimal alternative ingestion point to ensure a seamless experience to viewers.
- Be format agnostic. The ability for you to ingest any media format directly into your partner's platform reduces operational complexity and the potential for failure. Not every platform can do this, so make sure to ask in advance. This approach also has the added benefit of removing the need to purchase and scale origin servers, as your content delivery network will take the strain.
- Use accelerated ingest technology. Finally, if you work with Akamai, we can also bring a new and unique methodology to bear: hybrid HTTP/UDP ingest that combines the reliability and stability of traditional TCP with the higher bitrates possible with UDP.

3. Ensuring Quality During Live Content Processing – Transcoding, Encryption, and Packaging

The video transcoding and packaging process has long been a point of complexity for technical producers. Ensuring your viewers receive the right video format and bitrate for their device and connectivity at that moment and the ability to scale to do this for unpredictable crowd sizes is one of the most challenging pieces of live video workflow. But today's demanding audience makes it essential to get it right to ensure a high-quality viewing experience. Many producers now use the inherent benefits of transcoding and packaging content in the cloud. This ensures viewers get the optimal format and bitrate for the device and connection they're watching on – thereby improving the viewing experience.

Unfortunately, the move to delivering high-profile live video through the Internet has attracted the attention of hackers who can rip unprotected live streams during these vulnerable stages of the workflow. High profile pay-per-view events, for example, are prime targets. In fact, the nature of piracy is shifting significantly from file sharing and downloading to video streaming. Streaming piracy is now a real threat, with 21% of illegal sites now generating revenues in excess of \$221m from ripping live streams³.

As such, protection of streams is of paramount importance, but it can be a complex and costly exercise — especially if rights contracts require multiple encryption technologies. Event producers should work closely with their video delivery partner during the event planning process to ensure all security measures are implemented. At a minimum, we recommend that event producers:

- Include SSL protection of the first mile for live video streams. This encrypts the stream, preventing the hacker from capturing any video content.
- Apply appropriate DRM technology based on the devices you want to deliver the content to, such as FairPlay Streaming for iOS devices. With good DRM, viewers without appropriate authorization will be unable to view the stream, even if they've successfully stolen it.

Producers also need to decide whether to apply encryption at the encoder or have their partner deliver encryption and serve DRM licenses in the cloud on their behalf. Cloud partners like Akamai that have robust protection against Distributed Denial-of-Service attacks, can help ensure that hackers can't access license delivery servers - so every angle is covered.

4. Ensuring Quality During Monetization

Live video streams that monetize in whole or in part by advertising have an added burden. That's because the most common workflow is to use one vendor for ad insertion and another for video delivery. This poses three challenges to the need for quality. First, whenever hand-offs occur, complexity is introduced and another point of failure is added. Second, video content and advertisements will often be of different quality or even different aspect ratios, resulting in a disjointed viewing experience. Third, when unanticipated crowds champion a program, the ad-insertion vendor can often fail under the load, resulting not only in poor viewer experience but also a loss of incremental ad revenue.

Akamai has tackled this problem by working with leading ad-insertion companies to simplify the process and improve the experience that viewers get with server-side ad insertion. Akamai Ad Integration Services are designed to insert adverts into video streams without quality degradation. By coupling live video streams and ad insertion in the same workflow, Akamai is able to help producers deliver online ads at scale of the highest quality. This means event producers can rest assured that ads will be engaging to their viewers, emulating a broadcast TV experience. This of course means less churn and more monetization opportunities.

5. Ensuring Quality during Playback

Uninterrupted live video stream delivery is critical to ensuring a high-quality viewing experience, but the challenges of the Internet, such as congestion, can still create problems. First, there is the challenge of delivering media to the vast array of devices, including mobile devices and connected TV's, across varying network types and conditions. Additionally, there is also the challenge of delivering live event video streams to unpredictable audience numbers, whether on a global or local level, at the highest possible quality.

Your media delivery partner must be able to support Adaptive Bitrate (ABR) streaming to provide high-quality viewing across the broad variety of network types — fixed or mobile — at varying connection speeds. ABR streaming technology provides superior scale, reliability, and reach. Make sure your media delivery partner is able to support a wide range of formats such as:

- HTTP Live Streaming (HLS) for iOS devices
- HTTP Dynamic Streaming (HDS) for devices running the Adobe® Flash® and AIR® runtimes
- Microsoft Smooth Streaming (MSS) for devices running Microsoft Silverlight®
- Dynamic Adaptive Streaming over HTTP (MPEG-DASH)

Since every event can be subject to unexpected viewing figures, it's critical that the content delivery platform has enough redundancy at both a global and local level to absorb all traffic peaks. Recent sporting events, such as the FIFA World Cup, witnessed concurrent viewing figures of nearly 6m and total event traffic volumes of over 222PB. While still unprecedented in global scale, viewers for large sporting events can be highly localized, which brings further challenges. Make sure your media delivery partner is able to scale to meet demand globally and locally. Being present in many ISP networks around the world can help ensure that your viewers will get the best experience possible. There are many new innovations underway for live stream delivery such as Akamai's acceleration technology, Infinite Edge. New innovations of this type will go further to improve the video quality and viewer experience.

6. Measuring Quality and Service Support During an Event

We've been tracing quality across the entire live video workflow, but the only way to know if you've achieved the desired effect is by careful analysis of the viewer experience. Was there any buffering? What was the bitrate quality across different regions? Were there local challenges to delivery? Your media delivery partner must provide media analytics, which measures the quality of the individual experiences of millions of viewers. It also helps you to troubleshoot any problems and provides insight into planning accuracy for future events.

Delivering Live Events With Akamai While the World is Watching

2014 Sochi Winter Games

- 24/7 global coverage
- 98 events
- 70% higher traffic than the 2012 London Summer Games
- 400% peak traffic rate growth
- Single event peak of 3.5 Tbps

2014 World Cup

- 50+ broadcasters
- 80+ countries
- 35,000 years of video delivered
- 200+ petabytes total delivered
- Top 3 games broke all records for streaming (5.8, 6.6 and 6.8 Tbps) – the highest traffic of any live sports event

2015 Superbowl XLIX

- 1.3M concurrent viewers (2.5x growth in average viewers per minute vs. 2013)
- 84.2 minutes average viewing time
- 2.5 Mbps average bitrate

2015 Grammy Awards

- 1.2 million viewers (35% increase from 2014)
- 5.89 views per user
- 4 camera angles, 9 bitrates, 36 streams

Simplifying the Live Event Delivery Process from End to End

The media industry has made great strides in perfecting the process of delivering high-quality live video at scale. Broadcasters and event producers can turn to a wide range of companies, technologies, and media services to support them in particular areas across the online video workflow – whether their needs are in encoding, packaging, delivery, playback, or across-the-board support. Piecing together and managing a workflow from different providers can get complicated fast, though, and connection points can present new points of failure.

Akamai can help. With industry-leading expertise built over years of delivering the world's largest live video events and a platform that can deliver high-quality content at scale, Akamai is one of the few providers that can enable a true end-to-end solution for live workflows in the cloud. With technologies designed to optimize processes at every phase, Akamai is uniquely able to control and protect quality across the entire workflow. Because our network of partnerships is so broad and deep at every step of the workflow, we can also work with companies to custom-design solutions that integrate different technologies and providers in a way that eliminates potential points of failure across the board.

As Internet video has evolved over the past two decades, Akamai has led the way in supporting the business models behind it. With innovations such as HTTP video which removed the shackles of media from servers to unlock the scale of the Internet, to high performance live workflow services, to new accelerated delivery technologies; As much as things have changed, we can expect that they'll get even more complex. Akamai will continue to innovate to keep live media moving faster forward, as well as your business. Let us help you.

1. Frost & Sullivan "Putting Broadcast Online Video Workflows in the Cloud"
2. Via-Orca study into illegal sports streams 2014



As the global leader in Content Delivery Network ([CDN](#)) services, Akamai makes the Internet fast, reliable and secure for its customers. The company's advanced web performance, mobile performance, cloud security and media delivery solutions are revolutionizing how businesses optimize consumer, enterprise and entertainment experiences for any device, anywhere. To learn how Akamai solutions and its team of Internet experts are helping businesses move faster forward, please visit www.akamai.com or blogs.akamai.com, and follow @Akamai on [Twitter](#).

Akamai is headquartered in Cambridge, Massachusetts in the United States with operations in more than 57 offices around the world. Our services and renowned customer care are designed to enable businesses to provide an unparalleled Internet experience for their customers worldwide. Addresses, phone numbers, and contact information for all locations are listed on www.akamai.com/locations.