



Adobe Primetime Technical Primer for Operators

Make Every Screen a TV



Adobe Primetime helps operators reach viewers on any IP-connected screen, simplifying IP-based distribution to any screen and creating more value for pay-TV service. With a unified, highly secure workflow for live, linear and video-on-demand (VOD) programming, Adobe Primetime delivers an engaging, personalized viewing experience on every device and desktop.

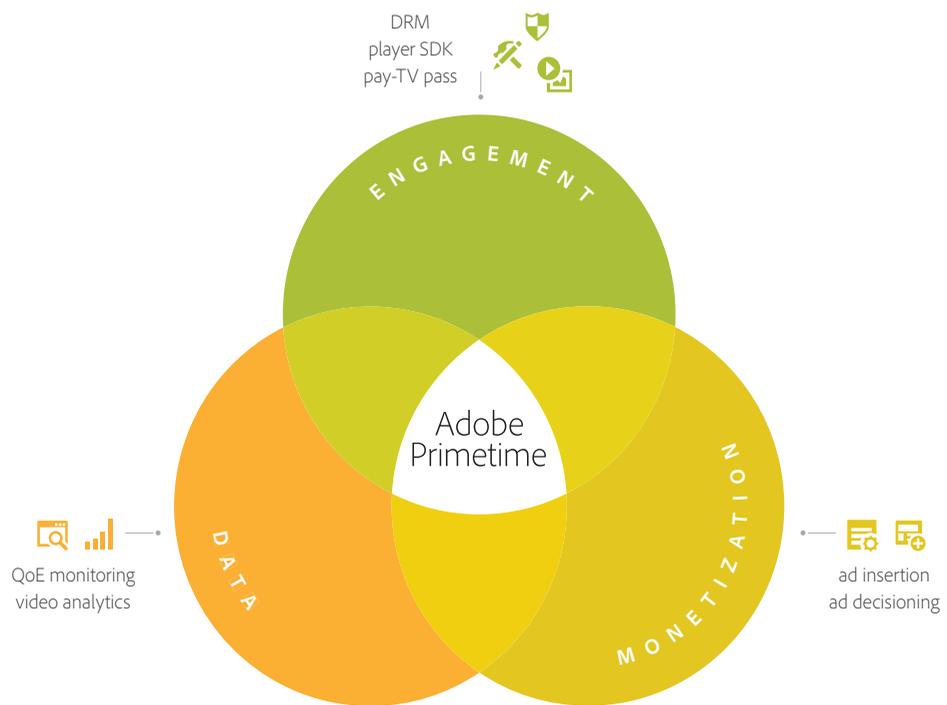


Figure 1: Adobe Primetime – A Complete Solution

Adobe Primetime capabilities are modular and interoperable with third-party publishing, monetization and optimization technologies. By building on top of the Primetime player SDKs, operators can continue to leverage existing broadcast, cable and satellite workflows and infrastructure, and deploy additional Adobe Primetime components as their business needs evolve.

Adobe Primetime meets strict studio DRM requirements and helps enforce TV Everywhere agreements, ensuring that consumers have ongoing access to premium content. Seamless ad insertion delivers a viewing experience that keeps audiences engaged, while delivering the most profitable ad decisions for any given campaign. Data drawn from quality-of-experience (QoE) monitoring, ad performance and entitlement, and more, comes together in a set of real-time dashboards to inform the delivery of personalized experiences to subscribers.

Intended Audience

This document provides a detailed technical overview of Adobe Primetime, intended for technical personnel within multichannel video programming distributors (MVPDs), Multiple System Operators (MSOs), pay-TV operators, satellite providers and telecommunications companies (telcos). For the sake of simplicity, these companies are called "operators" throughout this document.

Many terms are used in the context of online video. See the Glossary for definitions of these terms and any acronyms that appear in this document.



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Make Every Screen a TV



Contents

Adobe Primetime Solution Overview	5
Design Philosophy	5
System Capabilities	5
Adobe Primetime Player SDK	6
Packaging SDKs	7
Adobe Primetime DRM	7
Adobe Primetime Pay-TV Pass	7
Adobe Primetime Ad Decisioning	8
Adobe Primetime Ad Insertion	8
Adobe Primetime Video Analytics	8
Adobe Primetime Quality-of-Experience Monitoring	9
Implementation Options	10
Adobe Video Stack	11
Developing with the Adobe Primetime Player SDK	13
Overview	13
Top-Quality Video Playback	13
Hardware Acceleration	13
Powerful Multiple Bitrate Logic	14
Consistency Across Platforms and Devices	14
Complete Documentation	14
Extensible for Added Services	15
Design Philosophy	15
Capability Highlights	16
Meeting the Challenges of Different Platforms	16
The Desktop	17
Mobile Devices (Android)	18
Mobile Devices (iOS)	19
The Digital Home	20
Analytics-Ready Players	21
Working with the Reference Design Kit	21
Publishing with Engagement in Mind	22
Overview	22
Design Philosophy	23

Capability Highlights	24
Deployment Flexibility	24
World's Largest Installed Base for DRM	24
Robust and Long-Lived Content Protection	24
Broadcast-Ready Functionality	24
A Single Publishing Workflow	24
Industry-Standard Solutions	24
Packaging SDKs & Specifications	25
Adobe Primetime DRM	25
Adobe Primetime DRM for HLS	27
Adobe Primetime Protected Streaming	27
Adobe Primetime Pay-TV Pass	28
Monetizing Video Content with Advertising	30
Overview	30
Design Philosophy	31
Capability Highlights	31
Ad Platform Implementation Options	32
Ad Decisioning	33
Campaign Management	34
Ad Experience Management	37
Automated Creative Preparation Service	39
Forecasting	39
Content Library	40
Redirect Support	40
Sales Rights	41
Ad Insertion	42
Inventory Management	43
Ad Routing	44
Ad Stitching	44
Ad Tracking & Reporting	44
Optimizing Video Strategy with QoE Monitoring and Video Analytics	45
Overview	45
Design Philosophy	46
Capability Highlights	46
Adobe Video Analytics	47
Adobe Primetime QoE Monitoring	48
QoE Overview Dashboard	48
Startup & Error Reporting Dashboard	49
Buffers & Bitrates Dashboard	49
Geography Dashboard	50
Content Type & Device Breakdown Dashboard	50
Glossary of Terms and Acronyms	51

Adobe Primetime

- ADOBE PRIMETIME SOLUTION OVERVIEW
- DEVELOPING WITH THE ADOBE PRIMETIME PLAYER SDK
- PUBLISHING WITH ENGAGEMENT IN MIND
- MONETIZING VIDEO CONTENT WITH ADVERTISING
- OPTIMIZING VIDEO STRATEGY WITH QOE MONITORING AND VIDEO ANALYTICS
- GLOSSARY OF TERMS AND ACRONYMS

Adobe Primetime Solution Overview

This chapter provides an overview of Adobe Primetime, including the design philosophy, system highlights, implementation options, the Adobe video stack, and the possible integration points within an operator's existing systems.

Design Philosophy

Adobe Primetime was created to solve a major problem for operators: the lack of a platform with a unified workflow for preparing, publishing, monetizing, and analyzing IP-delivered video.

In the past, operators were forced to build their own online video systems by assembling apps and services from many different vendors. This consumed time and money, caused glitches, necessitated workarounds, and ultimately undermined the consumer experience.

These problems were amplified by the fragmented market for online video, with different operating systems, browsers, and mobile devices, many of these with different chipsets, firmware, device drivers, and screen size.

All these moving parts were updated at unpredictable intervals, so that any developer seeking to provide consistent video playback had to closely monitor the latest versions of each operating system, browser, and device—and then develop appropriate workarounds for any gaps or inconsistencies. In some cases, there were not yet any established industry standards, and certain systems could not exchange data smoothly, causing further headaches. All this distracted developers from creating a unique and robust consumer experience, and reduced overall ROI for operators.

Adobe Primetime was designed to solve these problems and help operators profit from video delivered to any IP-connected screen.

System Capabilities

Adobe Primetime provides a rich set of core capabilities. Table 1 shows the essential functions of each capability; additional highlights are given in the descriptions that follow. The rest of the chapters of this primer provide a more detailed description of each module, in the same order as listed in Table 1.

Table 1: Adobe Primetime Capabilities

Player SDK	Helps developers build players that provide consistent, top-quality video playback on any IP-connected device with seamless integration across Adobe Primetime DRM, monetization, and analytics capabilities
Packaging SDKs	Help developers prepare, encrypt, and deliver content that adheres to industry standards
DRM	Provides scalable, efficient workflow to protect premium video across devices and through various business models
Pay-TV Pass	Verifies pay-TV subscribers within programmer-provided sites and apps so they can access approved content on IP-connected devices beyond set-top boxes
Advertising	
Ad Decisioning	Supports every aspect of campaign and inventory management with efficient workflow
Ad Insertion	Enables monetization of TV programming across devices by seamlessly inserting ads into video content
Analytics	
Video Analytics	Extends Adobe Analytics with 10-second data collection and video-specific features to measure, analyze, and optimize online video and ad content
Quality-of-Experience Monitoring	Displays real-time data on Quality-of-Experience (QoE), engagement, and ad metrics

Adobe Primetime Player SDK

The Adobe Primetime player SDK includes all of the necessary tools and documentation to build and deliver a premium video experience on any IP-connected screen. Players built with the Adobe Primetime player SDK have access to all the key features considered necessary for premium video delivery at massive scale: content preparation, DRM, ad insertion, variable bitrate selection, hooks to collect engagement and quality-of-experience (QoE) data, and more.

This SDK covers the desktop (Microsoft Windows® and Mac OS X®), mobile devices (Android™ and iOS), digital home devices (Roku® and Xbox®) and numerous other smart TVs and set-top boxes; in other words, virtually every connected device that consumers use to access online video today.

Adobe Primetime

- ADOBE PRIMETIME SOLUTION OVERVIEW
- DEVELOPING WITH THE ADOBE PRIMETIME PLAYER SDK
- PUBLISHING WITH ENGAGEMENT IN MIND
- MONETIZING VIDEO CONTENT WITH ADVERTISING
- OPTIMIZING VIDEO STRATEGY WITH QOE MONITORING AND VIDEO ANALYTICS
- GLOSSARY OF TERMS AND ACRONYMS

Developers can use this SDK to dramatically shorten ramp time to address new platforms, meet new regulatory requirements, and minimize the complexity due to the different configurations that each platform presents. This provides maximum audience reach for minimum development effort.

Players built with the SDK integrate automatically with Adobe Primetime Quality-of-Experience (QoE) monitoring, enabling a near real-time view into any playback errors that may impact audience engagement.

Packaging SDKs

Adobe supports a consistent publishing workflow built around HLS that makes it faster and easier to publish video content for all IP-connected devices. The system includes a comprehensive set of software libraries and streaming protocols that enable other members of the video publishing ecosystem (such as CDNs and encoders) to support industry-standard protocols for preparing, encrypting, and delivering video content.

This ensures compatibility with key capabilities such as Adobe Primetime DRM, Adobe Primetime ad insertion, and player features such as closed captioning, trick play for fast-forward and rewind, and other enhancements to the consumer experience. The Adobe Primetime packaging SDKs are used by companies such as Cisco and RGB Networks to prepare, encrypt, and deliver content compatible with Adobe Primetime.

Adobe Primetime DRM

The DRM capability of Adobe Primetime—formerly known as Adobe Access—provides the most scalable, efficient workflow to help operators deliver and protect premium video across desktops and mobile devices. Every major Hollywood studio has approved apps and services that use Adobe's DECE-approved DRM. Adobe Primetime DRM and protected streaming technologies enable operators to extend their audience reach and support a broad set of business models, including rentals, subscriptions, and downloads, both directly and through syndication or distribution partners.

Adobe Primetime Pay-TV Pass

The Emmy award-winning pay-TV pass capability of Adobe Primetime—formerly known as Adobe Pass—is a universal, user-friendly system for unlocking pay-TV content on any device. A pioneer in the concept of "TV Everywhere," Adobe now powers more than 120 TV Everywhere sites and apps, and integrates with more than 230 U.S. operators, representing 99% of all U.S. pay-TV households. The innovation continues with consumer-driven features such as auto-authentication, where subscribers to both an operator's broadband and pay-TV offering are authenticated automatically. The service also provides real-time monitoring capabilities to detect issues and multiple fail-over protocols to protect operators from outages that could prevent subscribers from accessing content during peak viewership, critical for the success of major live events with huge concurrent audiences.

For operators, Adobe Primetime pay-TV pass helps strengthen relationships with subscribers by providing a secure, multi-screen viewing experience. Adobe Primetime pay-TV pass requires no downloads or plug-ins and delivers a hassle-free viewing experience for consumers. The programmers leveraging Adobe Primetime pay-TV pass today include ABC, Disney, ESPN, Fox, NBCU, NFL, Starz, Turner, Viacom, and more.

Adobe Primetime Ad Decisioning

Adobe Primetime ad decisioning provides campaign management, creative trafficking, forecasting, inventory management, partner management, reporting, and TV Everywhere support to improve operational efficiency and visibility.

Built from the ground up for live, linear (simulcast), and on-demand video content in TV Everywhere environments, Adobe Primetime ad decisioning is an optional capability of Adobe Primetime. For companies that use third-party ad servers, Adobe can develop custom integrations that extend the lives of legacy infrastructure, or redirect using industry-standard protocols such as VPAID, VMAP and VAST.

In addition to a unified, cross-platform solution, operators need a partner they can trust. Adobe Primetime is certified under SAS 70, accredited by the MRC, and compliant with all relevant IAB standards. The system offers 24/7 QoS monitoring, infrastructure scaled for trillions—not just billions—of transactions, and real-time fraud detection. Support and engineering teams are staffed around the world 24/7/365.

Adobe Primetime Ad Insertion

The ad insertion capability of Adobe Primetime enables operators to monetize TV programming across digital devices by seamlessly inserting advertisements into live, linear, or VOD content. This allows for dynamic ad execution into any content type on any IP-connected device, creating an engaging, buffer-free ad and content experience for viewers. Flexible, scalable, simple monetization capabilities can be delivered in either client- or server-side implementations, with turnkey integrations across third-party ad servers.

While the seamless consumer experience gets the most attention, the logic that drives Adobe Primetime ad insertion also includes sophisticated inventory management, ad routing, and IAB-compliant impression tracking and reporting capabilities.

By combining Adobe Primetime ad decisioning and Adobe Primetime ad insertion, operators can manage ad campaigns against opportunities, while preserving their existing business models through shared sales rights. This reduces friction across the video and advertising workflow. Tight integration with the player SDK, analytics, and third-party video content management systems (VCMS) enables Adobe Primetime to gather and report all the information that operators need to effectively monetize every stream.

Adobe Primetime Video Analytics

Adobe Primetime is fully integrated with Adobe Analytics video essentials, including the new 10-second "heartbeat" video playback reporting, which provides high-accuracy analysis of engagement.

Adobe Primetime

- ADOBE PRIMETIME SOLUTION OVERVIEW
- DEVELOPING WITH THE ADOBE PRIMETIME PLAYER SDK
- PUBLISHING WITH ENGAGEMENT IN MIND
- MONETIZING VIDEO CONTENT WITH ADVERTISING
- OPTIMIZING VIDEO STRATEGY WITH QOE MONITORING AND VIDEO ANALYTICS
- GLOSSARY OF TERMS AND ACRONYMS

Adobe Analytics includes video-specific features that provide operators with one place to measure, analyze, and optimize based on data integrated from all online video across multiple distribution channels. This data measures video-specific audience engagement metrics (e.g., audience average, audience minute, time spent) as well as ad performance metrics (e.g., ad impressions, pod placement, drop-off).

And because the core set of video metrics and dimensions is collected in a standard way, video data behaves just like other site data within Adobe Analytics, and can be added to non-video reports. This helps operators understand how digital strategy is performing across all content types.

Adobe is continuing to deliver against our vision of providing an integrated data platform that drives higher-quality experiences, longer and deeper viewer engagement, and better monetization.

Adobe Primetime Quality-of-Experience Monitoring

New quality-of-experience (QoE) monitoring in Adobe Primetime enables operators to collect real-time analytics for quality of service (e.g., bitrate, buffers, errors), engagement (e.g., concurrent audience, time spent), and ads (e.g., impressions, pod placement, ad ID). Data is available within 10 seconds of playback and updated every 10 seconds, so that customers can troubleshoot any problems as they arise.

New real-time dashboards in Adobe Primetime provide audience engagement information across content and ads, giving insight into who's watching and what's happening right now, which is especially valuable for live content.

The same real-time data used by the operations team is automatically available in Adobe Analytics for deeper historical analysis, creating an integrated data platform for real-time and historical data and eliminating the traditional silos between operations and marketing/analyst teams.

Implementation Options

Adobe Primetime capabilities are modular and interoperable with third-party publishing, monetization, and optimization technologies. By building on top of the Adobe Primetime player SDK, operators can continue to leverage their existing broadcast, cable, and satellite workflows and infrastructure, while deploying additional Adobe Primetime components as their business needs evolve.

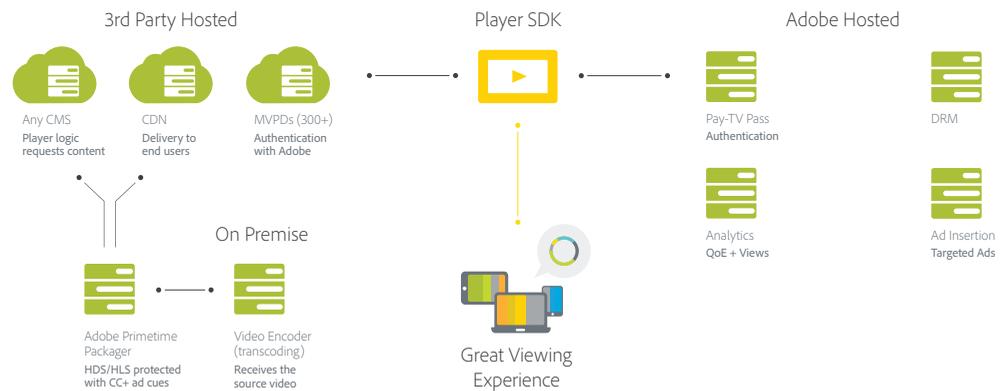


Figure 2: Typical Implementation Scenario

As shown in Figure 2, the typical operator has a mixed infrastructure, with some hosted by Adobe, some by third-party providers, and some as on-premise deployments. Whatever the operator's specific configuration, the Adobe Primetime player SDKs help bring it all together and provide a great viewing experience for the consumer.

Adobe Primetime maintains some traditionally on-premise elements of this architecture in the cloud. This enables operators to rapidly build out a proof of concept for a given class of assets or events. For example, standing up a packager and operating an origin server can be time-consuming and complex. Once the proof of concept has run successfully, the operator can deploy the hardware and servers in their data centers with confidence.

Adobe Primetime

- ADOBE PRIMETIME SOLUTION OVERVIEW
- DEVELOPING WITH THE ADOBE PRIMETIME PLAYER SDK
- PUBLISHING WITH ENGAGEMENT IN MIND
- MONETIZING VIDEO CONTENT WITH ADVERTISING
- OPTIMIZING VIDEO STRATEGY WITH QOE MONITORING AND VIDEO ANALYTICS
- GLOSSARY OF TERMS AND ACRONYMS

All the capabilities of Adobe Primetime are already integrated for quick, turnkey implementations. Using these capabilities together provides many benefits:

- Pay-TV pass monitoring data can be used to provide additional insights into subscribers viewing patterns happening across programmer sites and apps. This usage data can be brought into Adobe Analytics to compare with data from operator-owned sites and apps for more comprehensive insights into subscriber behavior.
- Data from Adobe Primetime ad decisioning can be brought into Adobe Analytics to combine data on website and app events with data on advertising CPMs and revenue.
- Video analytics data can be combined with Adobe Analytics to correlate content engagement metrics with website and app behavior metrics.
- Data from all services can be combined with other first-party data to create and manage audience segmentation.

Adobe Primetime capabilities are straightforward to integrate with existing third-party or homegrown solutions, by using standards such as VAST or VMAP, or where industry standards do not yet exist, through Adobe Primetime’s published methods.

Adobe Video Stack

Adobe Primetime provides the integrated video stack shown in Figure 3. This complete technology stack simplifies publishing video content to multiple screens at massive scale, so that operators can reach more devices, quickly and securely, and measure their audience and the results of their ad campaigns.

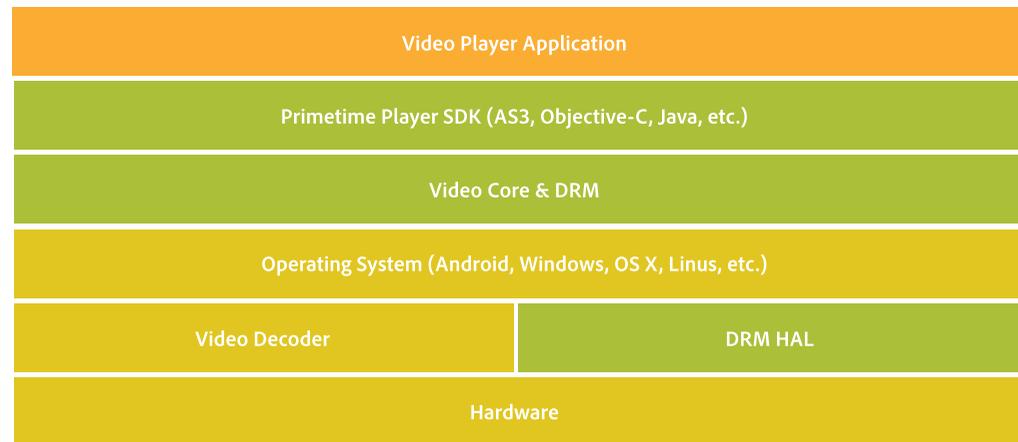


Figure 3: The Adobe Video Stack

A key feature of Adobe Primetime is that it provides the only video engine available with full content protection on HLS streams in Flash on the desktop. Adobe's HLS implementation provides several capabilities beyond what is available through most native video stacks. These capabilities include:

- Enhanced frame-accurate seeking and trick play support
- Customizable failover and error handling
- Client-side content splicing framework
- Intelligent fallback to a different video rendition if a certain content profile cannot be decoded

As shown in Figure 3, a developer creates a video player application to access the high-performance video playback engine and DECE-approved DRM through the Adobe Primetime player SDK. This provides consistent, top-quality video playback across Windows and OS X desktops, Android and iOS mobile devices, Roku and Xbox digital home systems, and a variety of smart TVs and set-top boxes. Adobe can add new features that become available across all these platforms.

By providing an Adobe Primetime DRM-ready HLS client on every major platform and device, the developer no longer needs to manage different media formats and DRM systems. On Apple iOS devices, Adobe integrates with the native HLS stack to provide this capability. For most other platforms, Adobe provides an advanced DRM-capable video engine that supports HLS. This makes it possible for the first time to build one publishing workflow that delivers fully protected content to a wide range of platforms and devices with consistent, HD-quality playback.

Adobe Primetime

- ADOBE PRIMETIME SOLUTION OVERVIEW
- DEVELOPING WITH THE ADOBE PRIMETIME PLAYER SDK
- PUBLISHING WITH ENGAGEMENT IN MIND
- MONETIZING VIDEO CONTENT WITH ADVERTISING
- OPTIMIZING VIDEO STRATEGY WITH QOE MONITORING AND VIDEO ANALYTICS
- GLOSSARY OF TERMS AND ACRONYMS

Developing with the Adobe Primetime Player SDK

This chapter describes the Adobe Primetime player SDK, including an overview, design philosophy, product highlights, platform-specific differences, and the Adobe Primetime framework for content splicing and ad insertion. The first section provides an overview, and the following sections address how the Adobe Primetime player SDK achieves consistent video playback and monetization across different platforms.

Overview

Based on Adobe's 10+ years of online video experience, Adobe Primetime is built on top of an industry-leading video engine optimized for high-quality playback on every major platform. Developers use the Adobe Primetime player SDK to leverage this engine in their applications. This means developers can forget about tracking platforms, browser versions, and the latest mobile devices, and instead focus on creating an excellent user experience for subscribers. The proven video-player technology from Adobe Primetime is designed to be future-proof: Ready for today's needs, and adaptable for tomorrow's innovations.

Top-Quality Video Playback

The Adobe Primetime player SDK solves the core problem of platform fragmentation, going deep into each individual operating system (OS) to provide a consistent, high-quality video experience for viewers. Adobe Primetime uses the same video stack on all platforms except iOS, where the video features are built on top of Apple's native video stack.

Hardware Acceleration

The Adobe Primetime player SDK takes full advantage of hardware acceleration on all platforms. Shifting processing from software to hardware lengthens battery life, improves performance, and mitigates issues such as dropped frames. For example, some startups offering HLS video stacks on Android use software decoding in the absence of developing direct relationships with chip manufacturers, which can be complex and difficult to navigate. Implementing full hardware decoding requires driver-level integration on each hardware platform. Adobe's position in the digital video industry enables us to engage directly with chipset vendors to enable hardware acceleration on a broad set of devices.

Powerful Multiple Bitrate Logic

Multiple bitrate (MBR) streaming works by detecting the consumer's bandwidth and CPU capacity in real-time and adjusting the quality of the video stream accordingly, picking the fastest possible bitstream that the consumer's device can accommodate.

Adobe's MBR switching logic provides the best experience for any given bandwidth. This logic also provides applications with advanced controls for bandwidth capping, and to control how aggressive or conservative the switching logic will be. Adobe Primetime provides a standard set of configurations that work under most conditions, while at the same time giving the developer access to certain parameters to tweak for specific needs.

Adobe Primetime's MBR logic is based on four years of tuning under real-world conditions at massive scale. Millions of streams are viewed every month using this technology.

Consistency Across Platforms and Devices

The Adobe Primetime player SDK provides a consistent API on all platforms and easy deployment to support new platforms with the same workflow. The SDK supports ad insertion, Adobe Primetime DRM, industry-standard closed-captioning, consistent error handling, and QoE metrics on playback. Specific versions of the Adobe Primetime player SDK are available for the desktop (Windows and OS X with any browser that supports Adobe Flash Player), Android, iOS, Roku, and Xbox.

Complete Documentation

As shown in Figure 4, the Adobe Primetime player SDK includes a complete set of documentation and samples that help a developer to get up and running quickly on each platform. A full set of reference clients can be used as a starting point to save time building a custom player. Test clients and diagnostic tooling make it easier to troubleshoot any issues.

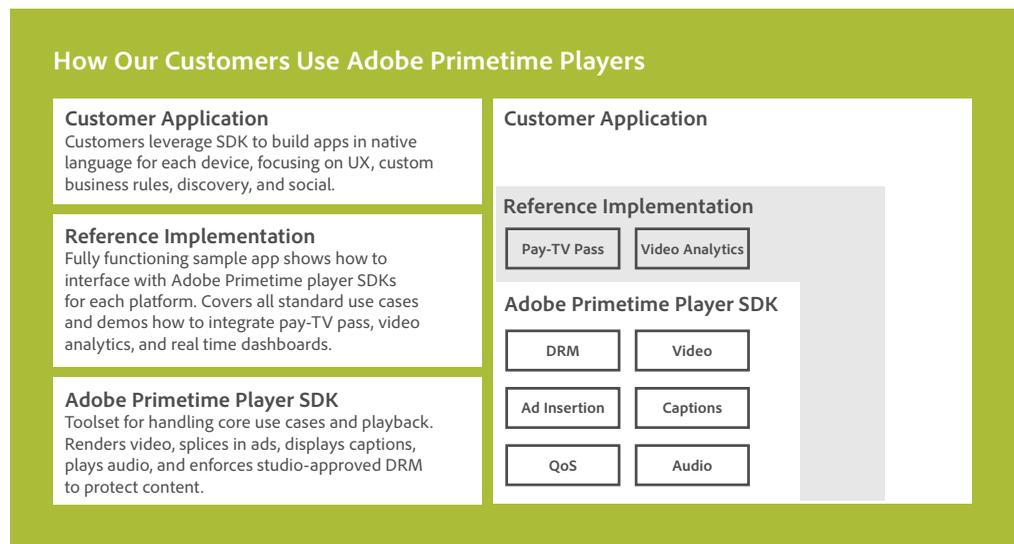


Figure 4: How Our Customers Use the Adobe Primetime Player SDK

Adobe Primetime

- ADOBE PRIMETIME SOLUTION OVERVIEW
- DEVELOPING WITH THE ADOBE PRIMETIME PLAYER SDK
- PUBLISHING WITH ENGAGEMENT IN MIND
- MONETIZING VIDEO CONTENT WITH ADVERTISING
- OPTIMIZING VIDEO STRATEGY WITH QOE MONITORING AND VIDEO ANALYTICS
- GLOSSARY OF TERMS AND ACRONYMS

Extensible for Added Services

The Adobe Primetime Player SDK provides a rich set of events and properties to help developers build additional services into their applications and platforms, including skinning and embedding. These enable an operator to embed a custom player on a webpage, reskinned to display certain user interface elements, to harmonize with a certain online environment, or to support overlay or companion ads.

Design Philosophy

The Adobe Primetime player SDK is designed to make it faster and easier to deploy complex media applications across a broad set of client platforms, with top-quality results. The Adobe Primetime player SDK achieves this by providing a consistent set of APIs and capabilities across all platforms, abstracting complicated platform-specific media APIs so the developer can focus on the consumer experience.

This also means the developer's knowledge and experience building an application on one platform can easily be transferred to other platforms.

The Adobe Primetime player SDK includes a rich set of notifications that can be triggered for every important event in the playback experience. For example, a developer can easily track the player moving from initialization to buffering to playback. Events are fired when ad pods (commercial breaks) are first entered, so that the player user interface can be updated as appropriate. Pausing, seeking, fast forward, and fast rewind are all signaled by events. The SDK provides APIs that describe the stream timeline in detail, including the active DVR window and ad pod positions, so that the developer can readily build a rich user interface on top of the SDK.

These notifications provide key inputs that the data collection engine in Adobe Primetime uses to gather, collate, and report for video analytics.

Of course, network problems and device failures can lead to errors. The Adobe Primetime player SDK provides detailed error reporting that enables the application to respond to any error conditions by starting a failover workflow or displaying a message to the viewer. For example, the SDK will report whether a playback failure was caused by a network problem, a corrupt media manifest, or a corrupt media file. In any case, the application can determine the appropriate message to show to the consumer – customizable by the operator – with an appropriate suggestion or workaround.

Adobe Primetime also provides for additional player services, including skinning and embedding.

Capability Highlights

The Adobe Primetime player SDK provides the following features to enhance engagement:

- Built-in support for DECE-approved content protection and business-policy enforcement using Adobe Primetime DRM
- Massively scalable content protection through Adobe's protected streaming
- Selectable output control and key rotation for linear, live, and VOD content
- Highest-quality multiple bitrate (MBR) video playback
- Trick play for familiar fast-forward and rewind functions
- CVAA-compliant closed captioning with support for CEA-608/708 and WebVTT caption formats
- Late-binding audio support, using multiple audio tracks against a single asset for multiple languages
- Robust failover and retry logic that safeguards viewers from interruptions
- Bitrate capping specifies the initial, minimum, and maximum bitrates for any session, which enables operators to save bandwidth, lock a session to the highest profile, or exclude certain bitrates from certain devices

The Adobe Primetime player SDK provides the following features that support monetization:

- Flexible capabilities for monetizing content with Adobe Primetime ad decisioning or third-party ad servers
- Seamless ad insertion across all devices, using either client- or server-side methods

The Adobe Primetime player SDK provides the following features for data collection and analysis:

- Integration with Adobe video analytics for advanced error and QoE data collection
- Real-time dashboards in Adobe Primetime provide audience engagement information across content and ads, giving operators insights into who's watching and what's happening now

Meeting the Challenges of Different Platforms

This section describes different platform-specific details of the Adobe Primetime player SDK covering the desktop (Windows and OS X), mobile devices (Android and iOS), and digital home devices (Roku and Xbox).

Developers can use this SDK to dramatically shorten ramp time to address new platforms and minimize operational complexity due to the different configurations that each platform presents. This provides maximum audience reach at the most scalable development effort.

Adobe Primetime

- ADOBE PRIMETIME SOLUTION OVERVIEW
- DEVELOPING WITH THE ADOBE PRIMETIME PLAYER SDK
- PUBLISHING WITH ENGAGEMENT IN MIND
- MONETIZING VIDEO CONTENT WITH ADVERTISING
- OPTIMIZING VIDEO STRATEGY WITH QOE MONITORING AND VIDEO ANALYTICS
- GLOSSARY OF TERMS AND ACRONYMS

The Desktop

Although premium video viewing on mobile devices is growing, the vast majority of online video viewing still occurs on the desktop. Adobe has more than a decade of experience enabling the best consumer video experiences for both Microsoft Windows and Apple OS X with any browser that supports Flash Player.

Adobe's ongoing commitment to the desktop is shown in the Adobe Primetime-only component of Adobe Flash Player, which is unlocked by the Adobe Primetime player SDK for the desktop, delivering HLS playback in Flash Player. (Please see <http://blogs.adobe.com/primetime/2013/12/adobe-primetime-1-2-adds-native-hls-support-to-flash-player/>)

Adobe Primetime provides secure HLS playback in Flash Player, including:

- Support for HLS 4 and 5 streams
- Encrypted HLS, PHLS, and Adobe Primetime DRM, depending on the level of protection required
- Alternate renditions

Built-in failover protection covers all the critical failures that can affect video playback:

- Server failover
- Client network failover
- Corrupted or missing segments
- Hardware decoder failover

The Adobe video stack also supports all these capabilities:

- Native 608/708 and WebVTT CC support with CVAA-compliant settings, so that consumers can modify the size, opacity, color, and edges of caption text and background
- Seamless client-side ad stitching
- Real-time analytics integration
- Player support for streaming protocols (e.g., Airplay, DLNA, Miracast) for streaming content to supported devices

The Adobe Primetime player SDK for the desktop abstracts the hardware video decoding and rendering pipeline across all Windows and OS X versions and browser combinations, using Direct3D, DirectX, DXVA, and OpenGL as appropriate, and leveraging any acceleration provided by each browser. This means without creating any browser-specific implementations, the developer can still count on video to play back consistently with all features across any browser that supports Flash Player.

The Adobe Primetime player SDK for desktop supports new platform features as they become available, while maintaining support for older versions.

For example, here are some specific browser capabilities that the Adobe Primetime player SDK for the desktop supports:

- Internet Explorer 9 and later, and Firefox version 10 and later, provide in-browser graphics composition acceleration that earlier browsers did not. Chrome version 21 and later support OpenGL-based hardware acceleration.
- Some browsers like Chrome and Internet Explorer support byte-range HTTP requests, while others like Safari and Firefox don't. Where this is available, the Adobe Primetime player SDK implements a native networking layer, but falls back to alternate built-in implementations where it is missing. This means the same streams work across all browsers and platforms.

Features available only in Adobe Primetime include:

- Buffering and multiple bitrate enhancements
- Fast/slow playback
- Hardware DRM support [Please see <http://blogs.adobe.com/primetime/2013/09/adobe-primetime-cloud-drm-service-and-amd-hardware-drm-support/>]
- Microsoft Protected Media Path support to provide kernel-level security
- Second-screen protocols

Mobile Devices (Android)

This section describes how Adobe Primetime supports the Android and iOS platforms with consistent, top-quality video players.

The Android platform presents some fundamental challenges to developers. Different devices use different chipsets, each with different specifications for video profiles, drivers, and CPU capabilities. The installed base is fragmented between different versions of Android, with no one version greater than 50% of the total installed base.

Each version of Android has major issues with video playback, including crashes, aspect ratio problems, seeking issues, errors on going to full-screen, and more. As long as the installed base remains fragmented, and different OEM vendors provide different customizations, consistent video playback on Android will continue to be challenging.

Fortunately, Adobe Primetime addresses these problems and provides a single, consistent implementation for problem-free video playback on Android devices.

Adobe works closely with the Android media team to ensure that the Adobe Primetime player SDK for Android provides a consistent viewing experience across multiple versions of Android using the most efficient media framework for each version. These range from the StageFright media framework for Android 2.3.x to the OpenMAX AL framework for Android 4.x.

Adobe Primetime

- ADOBE PRIMETIME SOLUTION OVERVIEW
- DEVELOPING WITH THE ADOBE PRIMETIME PLAYER SDK
- PUBLISHING WITH ENGAGEMENT IN MIND
- MONETIZING VIDEO CONTENT WITH ADVERTISING
- OPTIMIZING VIDEO STRATEGY WITH QOE MONITORING AND VIDEO ANALYTICS
- GLOSSARY OF TERMS AND ACRONYMS

The Adobe Primetime player SDK for Android addresses the significant device, chipset, and firmware fragmentation of the Android installed base with a robust, patent-pending hardware failure-protection layer. This layer detects which stream configurations will experience bugs or will not work on a particular chipset or device, and optimizes the streams for that device.

This failure-protection mechanism for Android uses heuristic data about chipset, device, firmware versions and failure rates, and data collected by Adobe over several years of major video deployments on the Android and desktop platforms.

The Adobe Primetime player SDK for Android supports video streams without fixed segment duration, sequence number matching, or key-frame alignment across various bitrate variants. This addresses the issue of packagers and segmenters that do not conform to the Adobe Primetime requirements for accurate ad-insertion of skip-free MBR switching.

Adobe Primetime's MBR algorithm uses several parameters to decide which streams to switch to, including bandwidth. This algorithm uses data on the consumer's device capabilities to decide which streams to play back with high frame rates, and which streams to avoid because the device can't handle them.

To improve the consumer experience, this decision happens before stream switching, not after. The MBR algorithm uses alternate server information that's normally available for network or server failover; it can also use that information to find a segment if files are missing due to packaging or deployment issues.

Highlights of the Primetime player SDK for Android include:

- A dual buffering mechanism that enables quick start of videos, without delays to fill the entire buffer
- Full control of content in the app on the end-user's device, as any section of the M3U8 playlist can be replaced with alternate content without updating the server's M3U8 file
- Time-accurate ad insertion on the client side, including ads inserted at non-segment boundaries, which is especially difficult for live events
- Frame-accurate seek, not restricted to keyframes alone
- Falling back to the correct MBR profile depending on the chipset capabilities for trick play
- Support for CEA-608, CEA-708, and WebVTT closed captions, with end-user overrides

Mobile Devices (iOS)

Apple iOS devices like the iPhone and iPad present another unique set of challenges. Native iOS applications must use the native HLS video stack from Apple, which provides a single HLS video decoder. This makes ad insertion and DRM difficult. Although video is rarely viewed over cellular connections, Apple strictly enforces the video guidelines for cellular and will block an app's approval on this basis.

The Adobe Primetime player SDK for iOS provides unique technology for client-side content and ad splicing that uses the native HLS video stack from Apple and complies fully with Apple's App Store guidelines. The SDK uses Apple-approved hooks in the native video player to manage ad insertion and DRM. All Adobe Primetime features are built on top of the iOS AVPlayer, which makes it easier to migrate applications built on AVPlayer to the Adobe Primetime player SDK. For optimum productivity for developers, the API calls are consistent across all platforms, including iOS.

The Digital Home

Two popular devices in the digital home are the Roku set-top boxes and the Xbox videogame console.

Roku set-top boxes provide consumers free and premium video content in both live and VOD formats and these devices are now supported by the Adobe Primetime player SDK. For example, live streaming is achieved through HLS. And since the Roku SDK is based on the same Adobe video stack, it provides all the same functions of Adobe Primetime including ad insertion, DRM, closed captioning, and analytics.

The native video stack for the Xbox 360® and Xbox One® supports only Microsoft's Smooth Streaming and Playready DRM for video playback. The Xbox 360 does not provide any native HLS implementation. Microsoft has published a sample HLS implementation, but it does not provide any content protection and remains largely unsupported. Several 3D software vendors provide an HLS implementation for the Xbox 360, but none of these support a complete DRM solution. Adobe's solution provides most of the features available in the other versions of the Adobe Primetime player SDK.

The Adobe Primetime player SDK for Xbox 360 was developed in C# and fully supports Adobe's HLS video stack, including the following features:

- High-quality video playback up to and including 1080p for live/linear and video on demand
- Trick play support
- Adobe Primetime server-side ad stitching
- VAST/VMAP redirects to third-party ad decisioning
- Client-side ad reporting
- 608 Closed Captioning (with master controls in Xbox to determine caption color and font)
- HLS AES segment encryption
- Adobe Primetime pay-TV pass integration in application layer
- Enhanced analytics with integration of QoS and real-time dashboards and video analytics

The Adobe Primetime player SDK for Xbox One is currently in limited alpha release. The Xbox One SDK will support the complete Adobe video stack and full suite of Adobe Primetime capabilities.

Adobe Primetime

- ADOBE PRIMETIME SOLUTION OVERVIEW
- DEVELOPING WITH THE ADOBE PRIMETIME PLAYER SDK
- PUBLISHING WITH ENGAGEMENT IN MIND
- MONETIZING VIDEO CONTENT WITH ADVERTISING
- OPTIMIZING VIDEO STRATEGY WITH QOE MONITORING AND VIDEO ANALYTICS
- GLOSSARY OF TERMS AND ACRONYMS

Analytics-Ready Players

The Adobe Primetime player SDK helps developers build players ready to tap into powerful analytics reporting that provides deep insights into audience engagement and the segmentation capabilities of the broader Adobe Analytics platform.

With the latest release of Video Analytics, video is even better integrated, featuring “heartbeats” at 10-second intervals for maximum accuracy, with the ability to differentiate content and ad playback. Adobe Primetime QoE monitoring enables operators to assess business and marketing KPIs in the context of video quality and its impact on audience engagement. For more details on Adobe Primetime video analytics, please see section 5.

Working with the Reference Design Kit

Comcast* has wrapped the Adobe Primetime video engine component library and built their implementation of the RDK Media Framework, using these capabilities as the advanced approach for full-featured TV experiences delivered over IP. The following Adobe Primetime capabilities are used in Comcast’s implementation: high-quality video playback, adaptive bitrate, trick play, DVR, alternate audio, closed captioning, digital program insertion (DPI) cues with support for SCTE-style broadcast signaling and client-side manifest stitching for seamless ad insertion, and roadmap support for blackout signaling. Content protection for IP video is also powered by Adobe Primetime in the RDK and supports the full range of Adobe Primetime DRM features. In order to leverage the Adobe Primetime-powered portions of the RDK, an operator would need to license those features through a direct business relationship with Adobe.

Publishing with Engagement in Mind

This chapter describes using Adobe Primetime to prepare and publish online video content, including an overview, design philosophy, overall product highlights, and more details on the capabilities of the Adobe Primetime packaging SDKs, Adobe Primetime DRM, and Adobe Primetime pay-TV pass.

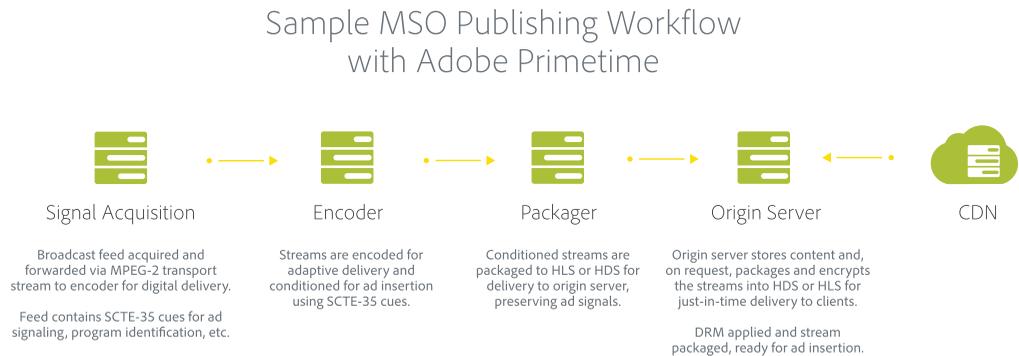


Figure 5: Adobe Primetime Publishing Overview

Overview

As shown in Figure 5, Adobe Primetime simplifies video distribution by providing a unified, multiplatform publishing and DRM workflow that leverages an operator's existing broadcast infrastructure.

To enable broadcast-quality content protection, closed captioning, ad insertion, and other critical features, Adobe Primetime defines a standard set of formats and protocols for delivering video content over IP. These include support for MPEG-2 transport streams, RTMP, HDS, and HLS at the origin portion of the workflow (ingest) plus support for HLS and HDS for delivery to the subscriber's video player.

Adobe Primetime-ready streams support ad signaling, blackout signaling, closed captioning, content metadata ingest, content protection, failover and fault-tolerance, and everything else required for delivering live, linear and VOD programming over IP.

To enable partners and operators to develop productive publishing workflows based on these formats and protocols, Adobe Primetime provides SDKs and reference software for delivering compatible video streams. Adobe is working with encoding vendors, publishing service providers, and CDNs to help build a growing ecosystem of third-party technologies that can deliver Adobe Primetime-ready streams.

Adobe Primetime

- ADOBE PRIMETIME SOLUTION OVERVIEW
- DEVELOPING WITH THE ADOBE PRIMETIME PLAYER SDK
- PUBLISHING WITH ENGAGEMENT IN MIND
- MONETIZING VIDEO CONTENT WITH ADVERTISING
- OPTIMIZING VIDEO STRATEGY WITH QOE MONITORING AND VIDEO ANALYTICS
- GLOSSARY OF TERMS AND ACRONYMS

Design Philosophy

The online video ecosystem includes many different vendors and service providers. In such a new field, certain industry standards and best practices are not widely accepted or may be missing altogether. Different members of the ecosystem will inevitably use different standards, so that preparing video content requires a complex, multistep workflow with numerous workarounds. This creates delays and headaches, and requires operators to invest resources in smoothing a sometimes tumultuous process.

As shown in Figure 6, Adobe Primetime is designed to streamline and rationalize the process of preparing, packaging, and protecting video for delivery to IP-connected devices. By providing comprehensive SDKs, built-in support for TV Everywhere authentication, and a robust and DECE-approved DRM, Adobe Primetime helps to create a single, smooth workflow. This saves operators development time, lowers their operating costs, and provides a superior viewing experience to more subscribers on more devices.

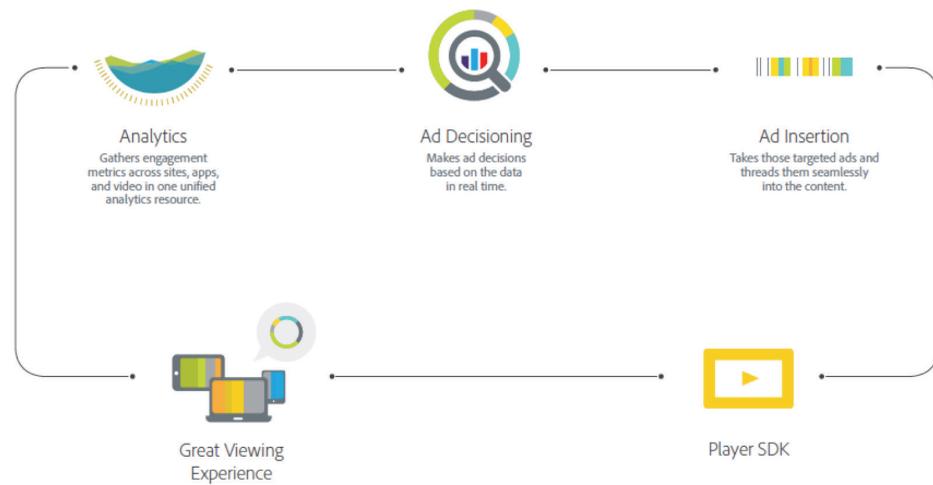


Figure 6: Adobe Primetime Monetization Capabilities

Capability Highlights

Deployment Flexibility

Adobe's proven packaging components can be used off the shelf or custom components can be built using Adobe Primetime SDKs and/or format specifications.

World's Largest Installed Base for DRM

Premium video DRM that works effectively across all platforms, including the desktop (Windows and OS X), mobile (Android and iOS), and digital home devices (Roku, Xbox, and many smart TVs and set-top boxes), gives Adobe Primetime the largest installed base for video to IP-connected devices.

Robust and Long-Lived Content Protection

Content protection remains bullet-proof over time, thanks to mechanisms like jailbreak protection, key rotation, and license rotation.

Broadcast-Ready Functionality

Including license and key rotation, license chaining, secure license return, and whitelisting that can restrict playback to trusted applications only.

A Single Publishing Workflow

Operators or third-party service providers can package and protect HLS content once, and then deliver protected HLS content to a vast range of supported platforms. This streamlined workflow saves both development time and operating costs.

Industry-Standard Solutions

Adobe Primetime Packaging SDKs enable industry-standard protocols such as HDS, HLS, and RTMP for a streamlined and consistent workflow. Adobe Primetime DRM has been approved for deals by all major U.S. movie studios, and for the UltraViolet cloud service from industry consortium DECE.

Adobe Primetime

- ADOBE PRIMETIME SOLUTION OVERVIEW
- DEVELOPING WITH THE ADOBE PRIMETIME PLAYER SDK
- PUBLISHING WITH ENGAGEMENT IN MIND
- MONETIZING VIDEO CONTENT WITH ADVERTISING
- OPTIMIZING VIDEO STRATEGY WITH QOE MONITORING AND VIDEO ANALYTICS
- GLOSSARY OF TERMS AND ACRONYMS

Packaging SDKs & Specifications

Publishing with Adobe Primetime uses the CDN only for HTTP caching, which opens the door to using multiple CDNs. Having fewer formats creates more efficient caching, better CDN pricing tiers, and potentially lower costs. Using Adobe Primetime for publishing can help operators streamline their workflow, gain flexibility, and save money.

Adobe provides a comprehensive set of software libraries and streaming protocols that enable other participants in the video publishing ecosystem (such as CDNs and encoders) to support industry-standard methods for preparing, encrypting, and delivering video content.

Following these standards enables several key capabilities of Adobe Primetime, including DRM, ad insertion, and player features such as closed captioning, trick play for fast-forward and rewind, and other enhancements to the consumer experience.

These SDKs enable protocols such as:

- HTTP Dynamic Streaming (HDS)
- HTTP Live Streaming (HLS)
- Real Time Messaging Protocol (RTMP)

Operators can continue to use their existing workflows for packaging with CDNs, or move to the Adobe Primetime packaging workflow. The benefits of using Adobe Primetime instead of CDN packaging include smooth, tested support for seamless ad insertion, and more options for content protection including protected HTTP dynamic streaming (PHDS) and protected HTTP live streaming (PHLS).

Additionally, full specifications are available for Adobe Primetime's protocols, such as RTMP, HDS and the Adobe Primetime extensions to HLS.

Adobe Primetime DRM

The DRM capability of Adobe Primetime—formerly known as Adobe Access—provides the industry's most scalable, efficient workflow for delivering and protecting premium video across desktops, mobile devices, and the digital home. Adobe Primetime DRM and protected streaming technologies enable operators to extend their audience reach and support a broad set of business models including rentals, subscriptions, and downloads, both directly and through syndication and distribution partners.

Adobe Primetime DRM is an industry standard: Every major Hollywood studio has approved apps and services that use Adobe's DECE-approved DRM.

Any effective scheme for DRM must balance tight content protection with a convenient and robust viewing experience. Adobe DRM achieves both through a powerful set of protective mechanisms that are effectively transparent to legitimate consumers.

Adobe Primetime DRM is a robust content-protection system, available across all platforms and devices supported by the Adobe Primetime SDK. Adobe Primetime DRM supports every important operator-ready feature for content protection, including:

- Application whitelisting to ensure that protected content only plays within approved applications from trusted packagers
- Domain management to bind content to a domain of devices all sharing a license under their business rules
- Device filtering so operators can exclude certain devices from specific content based on screen type, OS, or hardware capabilities
- Key and license rotation that can be set either to a certain number of seconds or to end-of-program, as preferred
- License chaining that supports a root license encrypted and bound to a certain device, with automatic updating of all related leaf licenses
- Selectable output controls to guard against consumer recordings

Some highlights of Adobe Primetime DRM include:

The world's largest installed base of any DRM on the desktop

DRM is available on any PC with Flash with no downloads or plug-ins required. This cuts delays and enables faster stream startup.

Deployment flexibility

In addition to on-premise license server management, Adobe Primetime DRM is now offered as a service. If an event calls for massive scale without the need for license management, Adobe Primetime's protected streaming can be used, secured with the same technology powering Adobe Primetime DRM.

Simplified key management

This cuts development time for applications and lowers the total cost of operations.

Superior consumer experience when device is incompatible with license

The Adobe Primetime player SDK's adaptive streaming selects a compatible rendition of the content, instead of failing entirely or reducing the resolution shown on the device. These errors can occur, for example, when HDCP is not available.

Fine-grained control over access to content

Licensing decisions can be based on specific characteristics of the device to provide more granular control.

Adobe Primetime

- ADOBE PRIMETIME SOLUTION OVERVIEW
- DEVELOPING WITH THE ADOBE PRIMETIME PLAYER SDK
- PUBLISHING WITH ENGAGEMENT IN MIND
- MONETIZING VIDEO CONTENT WITH ADVERTISING
- OPTIMIZING VIDEO STRATEGY WITH QOE MONITORING AND VIDEO ANALYTICS
- GLOSSARY OF TERMS AND ACRONYMS

Some DRM systems lose effectiveness as time passes. This is not the case with Adobe Primetime DRM, which controls access to clients that may have been breached through license revocability and renewability. Sophisticated mitigation techniques help prevent break-once, run-everywhere attacks. Jailbreak protection for mobile platforms helps ensure the integrity of the client. Key rotation and license rotation ensure that a single key is not used for an extended period of time, reducing the risk of unauthorized access to content.

Adobe Primetime DRM for HLS

Adobe Primetime DRM for HLS uses an Adobe proprietary method to manage HLS keys for iOS devices with the same robust DRM stack used for other platforms. This is enabled by Adobe's unique method of M3U8 manifest handling on iOS devices, the same technique used to provide ad-splicing services. Every major Hollywood movie studio has approved content deals using Adobe Primetime DRM for HLS.

Adobe Primetime Protected Streaming

Traditional DRM systems seek to authenticate and authorize each individual device and playback session, but this is not always necessary for online video. Consider the use case where an operator wants to license free content to a website to be monetized through advertising; in this case, a traditional DRM approach would be expensive overkill. The operator's only concern is that no viewer can pirate the same video content.

For this use case, Adobe Primetime protected streaming provides much of the robust security of a full DRM solution with no need to deploy license server infrastructure, and at a lower price point. This protected stream uses a single set of encrypted policy data spread across a large number of client devices, such as all website subscribers to a certain website. This enables the CDN to cache all the license information, which significantly lowers the cost of distributing licenses.

The operator can be assured that Adobe's technology will validate the video playback and ensure that the content is not tampered with. This technology is available for both Adobe HDS (PHDS) and HLS (PHLS).

To scale effectively, HTTPS key exchange requires the operator to deploy extensive resources for SSL acceleration, since by definition every HTTPS call from a consumer must terminate at the key server. HTTPS key exchanges also require complex management of client certificates to prevent unauthorized access to the key through a simple download.

In contrast, PHLS requires no key exchange whatsoever. The key is provided as part of the encrypted PHLS metadata delivered with the content. This key is decrypted in a secure area inside the Adobe Primetime DRM client on the consumer's device using whitebox cryptography. The DRM metadata itself can be fully cached by the CDN. The result is a robust, highly scalable system for delivering keys to subscribers that boosts security and lowers key delivery costs.

Another weakness of HTTPS key exchange is that it cannot specify any policies to enforce on the client. There is no way to specify the start or end dates for a license, the duration of a lease, or any output controls, such as requiring HDCP for HD content.

PHLS supports all the policy-enforcement capabilities of Adobe Primetime DRM. This means that license expiry and lease durations can be managed, and output control requirements can be enforced. If these functions were in the application, they would be much easier to tamper with. PHLS performs these actions within a tamper-resistant secure area.

Another unique feature that flows from fully supporting Adobe Primetime DRM: PHLS can bind content to be played only by certain trusted applications. This can be used to manage access to the content via syndication partners, and prevents unauthorized consumers from simply passing the control URL to a different video player.

Adobe Primetime Pay-TV Pass

TV Everywhere enables pay-TV customers to access premium content on multiple devices, both at home and on the go. Adobe Primetime pay-TV pass is a hosted service that takes TV Everywhere from concept to reality by verifying a viewer's access to content in a simple and secure way, creating more value for pay-TV service.

The Emmy award-winning pay-TV pass capability of Adobe Primetime—formerly known as Adobe Pass—is a universal, user-friendly system for unlocking pay-TV content on any connected device. A pioneer in the concept of "TV Everywhere," Adobe now powers more than 120 TV Everywhere sites and apps, and integrates with more than 230 operators, representing 99% of all U.S. pay-TV households.

As a hosted service, Adobe Primetime pay-TV pass requires no additional downloads or plug-ins, and delivers a seamless, hassle-free viewing experience for consumers. Programmers now leveraging Pay-TV pass include ABC, Disney, ESPN, Fox, NBCU, NFL, Starz, Turner, Viacom, and more.

For operators, Adobe Primetime pay-TV pass helps strengthen relationships with subscribers by providing a secure, multi-screen viewing experience. It saves development time and operating costs, and dramatically simplifies managing a myriad of different relationships with programmers and pay-TV providers.

Adobe Primetime pay-TV pass is available as a hosted service that enables secure communications between consumers, programmers, and operators to establish a user's entitlement to content. This enables rapid back-end integration based on existing business rules, with quick time to market, and a more secure environment to prevent fraud. For consumers, this delivers a superior experience, with more content available to more people across more platforms.

Adobe Primetime

- ADOBE PRIMETIME SOLUTION OVERVIEW
- DEVELOPING WITH THE ADOBE PRIMETIME PLAYER SDK
- PUBLISHING WITH ENGAGEMENT IN MIND
- MONETIZING VIDEO CONTENT WITH ADVERTISING
- OPTIMIZING VIDEO STRATEGY WITH QOE MONITORING AND VIDEO ANALYTICS
- GLOSSARY OF TERMS AND ACRONYMS

Adobe Primetime pay-TV pass includes three core components:

1. **The Access Enabler**, a small file loaded into a programmer's webpage or into the player application on the device client side, which serves as the glue for the overall TV Everywhere ecosystem
2. **The Adobe Primetime pay-TV pass server**, a hosted server that securely communicates with both the Access Enabler on the client and the existing authentication systems of the pay-TV operators
3. **The Media Token Verifier** to validate the authentication; the final step in the process where the validation of a user's entitlement can securely fit into the overall CDN token workflow

Adobe Primetime pay-TV pass can be used as a standalone service option. It is also available pre-integrated with the other capabilities of Adobe Primetime to streamline the publishing, monetization, and optimization of TV Everywhere distribution for operators.

Adobe also provides a client-less set of web services to integrate with devices that are not web-capable, such as certain smart TVs, set-top boxes, and game consoles. These RESTful web services provide access to the Adobe Primetime pay-TV pass entitlement workflow.

With Adobe Primetime pay-TV pass, operators can do one quick and easy integration using the appropriate APIs to access the entire ecosystem of programmers and reach 99% of all pay-TV households in the U.S.

The Adobe solution provides the convenience of single sign-on (SSO), so that subscribers don't need to log in repeatedly after their first authentication, even as they access different TV Everywhere sites and apps. Other features include auto in-home authentication (subject to operator capabilities) where no login is required. The service also supports advanced use cases like parental controls, local blackout restrictions, and fraud limiting.

(The alternative, directly integrating with each individual provider, does not provide the flexibility of an SSO that persists as subscribers move from site to site across the Internet. Multiple integrations also introduce needless complexity and consume valuable development resources.)

Adobe Primetime pay-TV pass has broad market penetration. The service supports apps running on virtually any connected desktop, mobile, or digital home device. Where Flash is available, Adobe Primetime pay-TV pass uses unique security features built into the Flash runtime to reduce fraud. On platforms that do not support Flash—mainly iOS—Adobe provides SDKs so that operators can build the same TV Everywhere functionality into native apps for devices.

Adobe Primetime pay-TV pass can be used as a standalone service option, but it is also available pre-integrated with other capabilities of Adobe Primetime that streamline the delivery, protection, and monetization of TV Everywhere programming.

Monetizing Video Content with Advertising

This chapter describes using Adobe Primetime to monetize video content with advertising, including an overview, design philosophy, overall product highlights, and more details on the capabilities of Adobe Primetime for ad decisioning and ad insertion.

Overview

The monetization capabilities of Adobe Primetime provide consistent ad management across any connected device, supporting both client-side and server-side mechanisms for inserting ads. This creates an optimal viewing experience for consumers, and addresses the key business needs for operators within a single workflow.

The ad decisioning capabilities of Adobe Primetime include efficient and powerful campaign management, experience management, forecasting, content library, redirect support, and sales rights for revenue sharing. Fine-grained opportunity management enables operators to allocate ad inventory between in-house teams and partners based on predefined rules and obligations. This reduces friction throughout the online video advertising workflow.

Adobe Primetime supports seamless ad insertion into live, linear, and VOD content, as well as replacement and alternate content when needed. The ad insertion capabilities include inventory management, ad routing, ad stitching, and ad tracking and reporting.

By combining both Adobe Primetime ad decisioning and Adobe Primetime ad insertion, operators can execute targeted ad campaigns and manage ad opportunities, while respecting their existing business arrangements through shared sales rights. Tight integration with the player SDK, video analytics, and video content management systems (VCMs) enables Adobe Primetime to gather and report all the data an operator needs to effectively monetize every stream.

Adobe Primetime

- ADOBE PRIMETIME SOLUTION OVERVIEW
- DEVELOPING WITH THE ADOBE PRIMETIME PLAYER SDK
- PUBLISHING WITH ENGAGEMENT IN MIND
- MONETIZING VIDEO CONTENT WITH ADVERTISING
- OPTIMIZING VIDEO STRATEGY WITH QOE MONITORING AND VIDEO ANALYTICS
- GLOSSARY OF TERMS AND ACRONYMS

Design Philosophy

Online video has evolved quickly, creating many new challenges for the industry. Video advertising has evolved from simple pre-rolls to mid-roll ads inserted in multiple ad breaks within a full-length episode. Complicating matters further, each device platform supports a different set of ad formats and experiences. Traditional ad servers were not built to handle this complexity.

The initial set of technical problems concerns how to effectively insert and serve video ads within a production workflow. Beyond this looms the larger issue of how to effectively monetize online video content, while respecting the traditional revenue-sharing models between operators and programmers, and finding innovative ways to serve targeted ads with online video content.

The goal of Adobe Primetime is to provide all the capabilities that operators need to maintain and grow advertising revenues, including a comprehensive set of tools and controls to provide powerful ad decisioning and flexible ad insertion at massive scale.

Capability Highlights

Executing video monetization strategy with the Adobe Primetime workflow provides many benefits, including seamless ad insertion across any connected device, highly granular control to create custom ad experiences, flexible ad insertion, and powerful opportunity management to help optimize results and, if preferred, route ads to third-party ad decisioning services.

Seamless ad insertion for live, linear, and VOD content

Adobe Primetime provides full support for both client-side and server-side ad insertion done seamlessly across any connected device, including desktops, mobile, and digital home devices.

Unique and customized ad experiences

Operators can control every aspect of pre-roll, mid-roll, and post-roll ads to create unique ad experiences using rules based on ad maps, content timelines, custom ad pods, or ad patterns.

Powerful opportunity management

Adobe Primetime meets the strategic challenge of allocating scarce inventory between in-house sales teams and an array of third-party partners, while respecting any existing legal contracts and business obligations for sales rights and revenue-sharing. The operator can set up business rules to manage complex relationships and allocate ad inventory accordingly.

IAB-compliant tracking and targeting

Adobe Primetime supports standard video ad formats defined by the IAB, and all the features required for geographic and demographic targeting, analytics for tracking, and overlays and companion ads that comply with all relevant industry standards.

Automated creative repackaging

Any incompatible ad creative delivered in FLV or MP4 format can be quickly transcoded and repackaged as HLS within minutes through an automated cloud service available from Adobe.

Comprehensive content library support

The system can ingest metadata from multiple VCMSs to create a content library that represents each channel, episode, series, and video asset. The operator can use this for ad experience management, forecasting, revenue share tracking, sales rights, and targeting. Every ad request will be matched to the episode or video asset in the content library, allowing for one-click targeting and reporting across multiple devices and programmers.

Detailed reporting

The ad platform can generate reports on ad monetization, availability, and geography that enable the operator to drill down to the specific video asset, creative, key-value, or zip code. An easy-to-use report builder enables the operator to create reports that access any field in the system. Reports can be broken down by the hour and set to any time zone. The system can also send scheduled reports to named users or external e-mails.

Integration with the Adobe Primetime player SDK

This tight integration supports advanced monetization tactics such as skip behavior, overlays and companion experiences.

Ad Platform Implementation Options

Due to the modular design of Adobe Primetime, operators can either use ad insertion and ad decisioning separately as standalone functions, or use both together to benefit from a fast, turnkey implementation.

Operators that use Adobe Primetime's ad insertion, ad decisioning, and video analytics capabilities can move data on ad impressions and revenue into Adobe Analytics to merge with data on website and application events. An operator can take first- and third-party subscriber data, including data collected using Adobe Analytics, and merge it to create audience segments that help dynamically target ads. Or an operator can simply use first-party subscriber data to target ads.

Adobe Primetime

- ADOBE PRIMETIME SOLUTION OVERVIEW
- DEVELOPING WITH THE ADOBE PRIMETIME PLAYER SDK
- PUBLISHING WITH ENGAGEMENT IN MIND
- MONETIZING VIDEO CONTENT WITH ADVERTISING
- OPTIMIZING VIDEO STRATEGY WITH QOE MONITORING AND VIDEO ANALYTICS
- GLOSSARY OF TERMS AND ACRONYMS

Using Adobe Primetime's monetization capabilities, operators can:

- Create a "no ads" rule to block ads from running on certain content or domains
- Prioritize rules to control exceptions (so that, for example, a "no ad" rule trumps all others)
- Apply rules automatically as content is ingested via the content metadata feed
- Control the rules for commercial breaks based on stream location or ad sequence
- Establish a minimum duration of content that must appear before any linear or non-linear ads (such as no overlays for clips less than three minutes)
- Set default display times for non-linear ads (such as 10 seconds)
- Manage insertion of non-linear overlays based on existence of pre- or mid-roll ads
- Set when the first non-linear ad should appear after a chapter start, and the frequency of all subsequent ads (such as every 60 seconds after the first ad)
- Preview non-linear ad experiences via a sandbox account
- Enforce content viewed between ads, including the minimum number of seconds of content viewed since the last overlay, the minimum number of clips loaded since the last overlay, or the minimum number of clips or seconds since the last linear ad

Ad Decisioning

Adobe Primetime ad decisioning enhances direct sales through extensive forecasting and robust campaign management, giving ad operations teams the tools they need to drive maximum ad dollars while eliminating channel conflict. This capability is rounded out by powerful creative trafficking, inventory management, partner management, reporting, and TV Everywhere support to improve operational efficiency and visibility.

Adobe Primetime ad decisioning was built from the ground up for live, linear, and VOD content in TV Everywhere environments. Ad decisioning is an optional Adobe Primetime enhancement available either as a standalone function or seamlessly integrated with the Adobe Primetime solution. For companies that use third-party ad servers, Adobe can develop custom integrations that extend the lives of legacy infrastructure, or redirect using industry-standard protocols such as VPAID, VMAP, and VAST.

Unlike other point product offerings, Adobe Primetime ad decisioning enjoys seamless integration with the other capabilities of Adobe Primetime including ad insertion, QoE monitoring, and video analytics. By combining the Adobe Primetime capabilities for ad decisioning and ad insertion, an operator can manage ad campaigns against opportunities, even while preserving their existing business arrangements through shared sales rights. Tight integration with the player SDK, video analytics, and VCMS enables Adobe Primetime to gather and report all the information the operator needs to effectively monetize every stream.

Campaign Management

Video ad campaign management includes setting up campaign goals and budgets, targeting campaigns to certain types of content or to certain consumers based on demographics or other data, and then trafficking the ads accordingly.

The heart of Adobe Primetime ad decisioning lies in the ad browser, a dashboard that enables operators to analyze thousands of ads (line items), informed by real-time data on ad impressions and revenues. Operators can understand campaign performance in real-time by bulk editing and building views based on more than 20 different metrics.

Ads can be targeted by numerous factors including content metadata, device, geography (down to the zip code), key value, site, and time of day. Content metadata is ingested into the system automatically, either pushed by the operator or pulled by the ad platform at scheduled intervals. Once ingested, this content metadata is available to every function of the Adobe Primetime system. For example, content metadata can be used for ad targeting and reporting, based on the assumption that any consumer viewing a certain type of content will likely be interested in similar content or will share properties with other consumers watching that type of content.

An operator can control ad delivery by CPC, CPM, frequency capping per consumer and per stream, and competitive exclusions. The system supports many different ad formats, including linear video, linear slate, overlays, ad bugs, skins, interstitials, companions, and traditional online display. An operator can target linear ads by pre-roll, mid-roll, post-roll, and position within a commercial break (such as the first slot), or shrink a multi-ad commercial break down to one ad to enforce 100% share of voice (SOV).

An operator can also segment their linear inventory by separating commercial breaks into different types of pods (such as paid vs. promotional) managed by different teams or organizations.

The operator can associate up to 12 master creatives with a single ad, and schedule changes and percentage-based rotations over the life of the ad. Multiple companion units can be associated with any ad that can be trafficked in seconds.

Multiple currencies are supported for ad budgeting and revenue reporting. Daily exchange rates are saved and all ads are converted to USD on the backend for delivery prioritization and accurate revenue-share reporting.

Adobe Primetime

- ADOBE PRIMETIME SOLUTION OVERVIEW
- DEVELOPING WITH THE ADOBE PRIMETIME PLAYER SDK
- PUBLISHING WITH ENGAGEMENT IN MIND
- MONETIZING VIDEO CONTENT WITH ADVERTISING
- OPTIMIZING VIDEO STRATEGY WITH QOE MONITORING AND VIDEO ANALYTICS
- GLOSSARY OF TERMS AND ACRONYMS

Beyond the ad experience controls available during ad insertion through ad maps, content timelines, custom ad pods, and ad patterns, Adobe Primetime ad decisioning also provides:

- Ad positioning within a pod, which can be exclusive (take over entire pod), first, last, or any spot
- Targeting an ad to a specific pre-roll, mid-roll or post-roll pod with the option of using a custom ad pod
- Serving across pods to allow an ad to appear numerous times instead of only once in a long-form stream
- Safeguards to ensure that no ad ever serves more than once within any commercial break
- Competitive separation to block any ad for the same vertical from appearing within any pod and within any stream

The campaign creation process includes two aspects, both creating a new campaign and creating ads. Campaigns can contain multiple ads, and also need to address multiple placements for the same ad, so Adobe Primetime has addressed and simplified this workflow.

In addition to the targeting described above, Adobe Primetime provides an efficient workflow for creating and trafficking ad campaigns, breaking down each campaign into three sets of properties:

- Campaign Details
- Ad Details
- Creative Details

Under Campaign Details, as shown in Figure 7, the operator can identify the campaign name, insertion order number, advertiser, agency, agency fee, category by vertical market, and budget currency. When specifying the ad category, the operator can choose to block any competitive ads from running in the same content.

Agency and advertiser	
Advertiser *	Adobe ▼ Or Create new advertiser Add
Agency	Select an agency ▼ % Agency fee
Category * ?	Electronic/Technology ▼ <input checked="" type="checkbox"/> Exclude competitive ads

Figure 7: Campaign Details Screenshot

Under Ad Details, as shown in Figure 8, the operator can provide many specifics about the campaign budget, delivery, and targeting.

The screenshot shows the 'Budgeting and flight' configuration panel. On the left, there are four sections: 'Budget options' with a help icon, 'Budget *' with a red asterisk, 'CPM *' with a red asterisk and help icon, and 'Impression goal *' with a red asterisk. The main area contains the following settings: 'CPM' is selected in a dropdown menu, 'Exclude from revenue' is an unchecked checkbox, the budget is '\$ 5,000.00' with a green lock icon and a 'Total' dropdown, the CPM is '\$ 5.00' with a grey lock icon, and the impression goal is '1,000,000' with a green lock icon. On the right side, there are three icons: a grey equals sign, a grey 'X', and a green lock icon.

Figure 8: Ad Details Screenshot

Under Creative Details, as shown in Figure 9, the operator can give many specifics about where the creative is hosted, the naming convention, any third-party redirects, and so on.

The screenshot shows the 'Creative Details' configuration panel. The left sidebar has three sections: 'Traffic options', 'Assets & URLs', and 'Impression tracking'. The main area contains the following settings: 'Creative' is selected in a dropdown menu, 'Ext. URL' is 'http://adobeprimetime-f.akamaihd.net/...' with a 'Preview' button, 'External progress tracking' is checked, and there is a table for progress tracking. The table has five rows with percentages and URLs. On the right, there is a video player with a black screen, the text 'Click play to start', and 'asset ID: 266238-105'.

Percentage	URL
0%	http://agencyadserver.com/0_progress
25%	http://agencyadserver.com/25_progress
50%	http://agencyadserver.com/50_progress
75%	http://agencyadserver.com/75_progress
100%	http://agencyadserver.com/100_progress

Figure 9: Creative Details Screenshot

Adobe Primetime

- ADOBE PRIMETIME SOLUTION OVERVIEW
- DEVELOPING WITH THE ADOBE PRIMETIME PLAYER SDK
- PUBLISHING WITH ENGAGEMENT IN MIND
- MONETIZING VIDEO CONTENT WITH ADVERTISING
- OPTIMIZING VIDEO STRATEGY WITH QOE MONITORING AND VIDEO ANALYTICS
- GLOSSARY OF TERMS AND ACRONYMS

Ad Experience Management

Adobe Primetime ad decisioning gives ad operators full control over the viewer experience for live, linear, and video on demand (VOD) content driven by either the content or the consumer.

- For full-episode VOD, operators can leverage ad maps to control the ad experience for individual assets or groups of content. The Adobe Primetime ad server enables operators to organize commercial breaks into pods (e.g., promotional, standard, sponsor), to specify the maximum pod duration, number of ads per pod, and maximum ad duration, and to set ad eligibility rules.
- For short-form VOD, operators can use ad patterns to control the ad experience for individual consumers and to specify the ad-to-content ratio and target patterns to specific consumers, content, devices, geography, or key values/audience segments.
- For linear or live streaming, Adobe Primetime ad decisioning supports dynamic passing of mid-roll duration at ad request, a default break duration, and a "kill" option to return to content at any time during commercial playback; this is useful, for example, during a live sports event when the play resumes after a timeout or offside.

Adobe Primetime supports four different approaches to control commercial break patterns and create a unique consumer experience: ad maps, content timelines, custom ad pods, and ad patterns.

Ad maps

Ad maps enable operators to create custom ad experiences for individual videos or groups of videos that specify the number of commercial breaks, how long each break should run, and how many ads can be served in each break.

The ad map can either default to the natural mid-roll cue points specified in the content metadata, or else override those cue points through an interface in Adobe Primetime. Ad maps allow commercial breaks to be turned on and off based on content metadata or consumer information such as cookies, key values, IP data, and so on.

Adobe Primetime's ad maps can be targeted to consumers based on key values or demographic information that is passed through the player or device. This allows customers to craft a differentiated ad experience for a certain group of consumers, whether they are watching the same or different pieces of content. Key values can also be used to control the session.

Ad maps can also automate Nielsen C3 (or C7) window management. This includes setting the C7 window rules, defining the operator's ad pod, and setting rules for when to allow dynamic ad insertion.

Content timelines

Adobe Primetime provides an alternative to ad maps that gives the operator's video content management system (VCMS) finer control over the ad experience for individual assets. This is achieved by specifying the exact content timeline and ad experience when publishing the content metadata.

For operators that choose this route, the Adobe team works with you during the implementation to define the ad experiences including pre-rolls, mid-rolls, and post-rolls, and to decide what type of ad units are eligible for different types of content. Mid-roll breaks are typically identified by chapter metadata ingested through a content feed into Adobe Primetime.

Adobe Primetime provides a robust set of controls to manage advertising policies for the consumer experience as well as partner and sales rights access. These policies can either be managed globally or else targeted specifically to any combination of domains, key values, metadata, or any other targeting information.

Custom ad pods

An ad pod is another term for a commercial break within an online video. Adobe Primetime enables customers to use ad pods to define highly specific ad experiences and customize them to the specific needs of the target audience.

An operator can segregate ad inventory within a single commercial break into different pods such as:

- Bumper Ad Pod, for example, with one ad running for 10 seconds max
- Sponsor Ad Pod, for example, with one ad running for 20 seconds max
- Standard Ad Pod, for example, with a maximum of three ads running for 90 seconds max, and any one ad running for 60 seconds max

Segregating ad inventory into different types of pods helps an operator create unique ad experiences. After an ad pod is created, the operator can apply it to specific content based on content timelines or ad maps. And any ad pod can be assigned to a certain sales team or be eligible only for certain targeted ads.

Ad patterns

Ad patterns are used to control the sequencing of ads in online video, analogous to setting up a playlist for content. Instead of making an individual decision on how and when to run each unique creative, the operator can decide how to fit a group of ads together, or sequence them in a natural progression; this is especially useful for sponsored content.

Ad patterns are mainly used to control the ad experience in short-form VOD clips. A side benefit of ad patterns is that they quickly reveal the ad-to-content ratio, which an operator may wish to keep at a certain setpoint. Adobe Primetime provides a simple-to-use interface to manage ad experiences globally, based on the same targeting criteria available for individual ads.

Adobe Primetime

- ADOBE PRIMETIME SOLUTION OVERVIEW
- DEVELOPING WITH THE ADOBE PRIMETIME PLAYER SDK
- PUBLISHING WITH ENGAGEMENT IN MIND
- MONETIZING VIDEO CONTENT WITH ADVERTISING
- OPTIMIZING VIDEO STRATEGY WITH QOE MONITORING AND VIDEO ANALYTICS
- GLOSSARY OF TERMS AND ACRONYMS

Within the advertising rules function of Adobe Primetime, an operator can manage an ad pattern along numerous dimensions, including:

- Content metadata, by channel (such as drama), duration (such as short-form) or genre (such as comedy)
- Domain (such as Fox.com) or environment (such as HTML5)
- Key values, by webpage (such as homepage) or end-user data (such as male or female)

Each linear commercial break (ad pod) can be defined by total duration, maximum duration of any one ad, and maximum number of ads. The operator specifies how much video content should appear before the next ad is eligible to appear.

With this approach, the operator can use the Adobe Primetime interface to quickly expand or constrain availability of inventory and effectively manage the consumer ad experience, without requiring any internal development resources.

Ad patterns can also be combined with ad maps to restrict the ad experience even further, while still controlling the ad-to-content ratio, the maximum duration of ad breaks, and the maximum duration of ads. Ad patterns can also overlap and be prioritized, so that one takes precedence over all others (such as a "no ad" rule trumps all other rules).

Automated Creative Preparation Service

One major pain point in creating a seamless ad experience is the need to provide all video ad creative in a streamable format. But many third-party ad providers do not consistently provide ad creative as HDS or HLS. To help bridge this gap for operators, Adobe provides an automated creative preparation service.

This service works this way: The video player can flag any creative incompatible with Adobe Primetime's content splicing and automatically submit that creative to the Adobe service. The service automatically does any required transcoding from FLV or MP4 into HLS, making the compatible creative available within a few minutes.

Meanwhile, the submitting player selects a different ad so that the original consumer's playback continues without delay, while the new creative is soon ready for any further viewers. Since the total number of ad creatives is much smaller than the total number of viewers, this ensures that correctly prepared ad creative is available for nearly all consumers.

Forecasting

Adobe Primetime ad decisioning forecasts by running a full simulation using all available data, rather than the sampling approach used in point product offerings. This results in the most accurate forecast possible, even capturing non-targeted key-value data to project available audience segments.

This capability helps operators to manage the complex interdependencies of the online advertising business, enabling the operator to accurately determine:

- How much ad inventory will be available for any given content
- How to sell that inventory most effectively to maximize revenue
- How to create an optimum ad experience for consumers so that one stream is not oversold while another is undersold
- Who has the right to sell each advertising slot between in-house teams and multiple partners

The forecasting algorithms in Adobe Primetime have been carefully tuned to capture frequency caps, time of day segments, and typical consumption patterns. This reflects the reality that news content, for example, is different from entertainment.

The system provides real-time forecasting for just-in-time availability checks in seconds. Inventory management reporting is available for in-depth sell-through and fill-rate analysis by domain, content metadata, key value, geography, ad position, and so on. Revenue forecasting is based on booked ads only. Contending ads can be reported to show which ads are competing for the same inventory.

The operator has complete flexibility in forecasting on key values, without ever having to predefine the variables to forecast on before starting to collect data. Instead, an operator can change forecasting on the fly based on any key-value pairs stored in the system.

Content Library

Operators can ingest metadata from one or more VCMSs to create a content library representing each channel, series, episode, and video asset. As many metadata fields as desired can be imported, and this data leveraged for targeting, forecasting, sales rights, revenue-share tracing, and ad experience management. Every ad request is matched to the episode or video asset in the content library, allowing for one-click targeting and reporting across multiple devices and operators.

Redirect Support

Adobe Primetime ad decisioning is the only video ad server that can read and generate both VAST 3.0 XML schemas and VMAP 1.0 playlists that comply with IAB standards. Other ad servers can only do one or the other. Both standards are essential for supporting TV Everywhere initiatives.

Adobe also provides enhanced VAST 2.0 support that goes beyond the standard to allow one ad request to return multiple ads. This creates the concept of a multi-ad pod without using VAST 3.0. Adobe Primetime ad decisioning can generate multiple ads for a single request, and can also interpret a response that includes multiple ads as an ad pod.

Adobe Primetime ad decisioning also provides full support for Video Player Ad-Serving Interface Definition (VPAID) 1.0 and 2.0, the IAB standards for an interface between video players and ad units that enable an interactive consumer experience.

Adobe Primetime

- ADOBE PRIMETIME SOLUTION OVERVIEW
- DEVELOPING WITH THE ADOBE PRIMETIME PLAYER SDK
- PUBLISHING WITH ENGAGEMENT IN MIND
- MONETIZING VIDEO CONTENT WITH ADVERTISING
- OPTIMIZING VIDEO STRATEGY WITH QOE MONITORING AND VIDEO ANALYTICS
- GLOSSARY OF TERMS AND ACRONYMS

Sales Rights

The business environment for an operator involves a complex network of existing partners and sales rights. Adobe Primetime ad decisioning enables operators to allocate inventory to internal sales teams and TV Everywhere partners using sales rights.

More specifically, the operator can direct ad calls to any ad server, sell-side platform (SSP), yield manager, or third-party source of demand such as an ad network, based on pre-defined rules and business obligations.

This reduces channel conflict throughout the broadcast-to-IP video advertising workflow, replicating the national-to-local ad inventory split from traditional TV broadcasting for any video delivered to a desktop or connected device.

Sales rights can be prioritized and targeted to similar ads to support complex carriage agreements. Adobe Primetime supports exclusive and first rights up to a specified percentage of inventory, as well as auctions based on CPM. Operators can create sub-accounts for different sales teams or marketing groups with permissions to work with specific content, devices, geographies, or sites.

Managing this complexity requires an automated system that provides quick lookup, smart rules, and effective allocation of ad inventory, the function known as ad opportunity management. This is a highly strategic part of monetizing video content, enabling an operator to create and apply appropriate business rules for how much time to allocate to advertising, who to allocate these advertising blocks to, and how to create an optimum consumer experience, at the same time as maximizing revenues from advertising.

Ad restrictions and experience rules can be enforced across sales teams, sub-accounts and partners using Adobe Primetime's partner management features, or by using VAST 3.0 or VAST 2.0 with VMAP 1.0.

An operator can target and prioritize contracts to allow for complex revenue-share tracking and calculations in multiple currencies. The system supports many standard fee structures including CPM, percentage, and volume tiers, as well as any custom fee structures required.

Ad Insertion

Any operator that plans to sell ads in online video content needs a highly reliable way to insert ads into the video stream to create a smooth and buffer-free ad experience. The ad insertion capability of Adobe Primetime supports the monetization of TV programming across digital devices by seamlessly inserting advertisements into live, linear, and VOD programming.

This allows for dynamic ad execution into video content on any IP-connected device, creating an engaging, buffer-free ad and content experience for viewers. Flexible, scalable, simple monetization capabilities can be delivered in either client- or server-side implementations, and with turnkey redirects to third-party ad servers.

The logic that drives Adobe Primetime ad insertion includes sophisticated inventory management, ad routing, and IAB-compliant impression tracking and reporting. Decreases in buffering (caused by a dual-player model) can drive increased engagement and increased revenue.

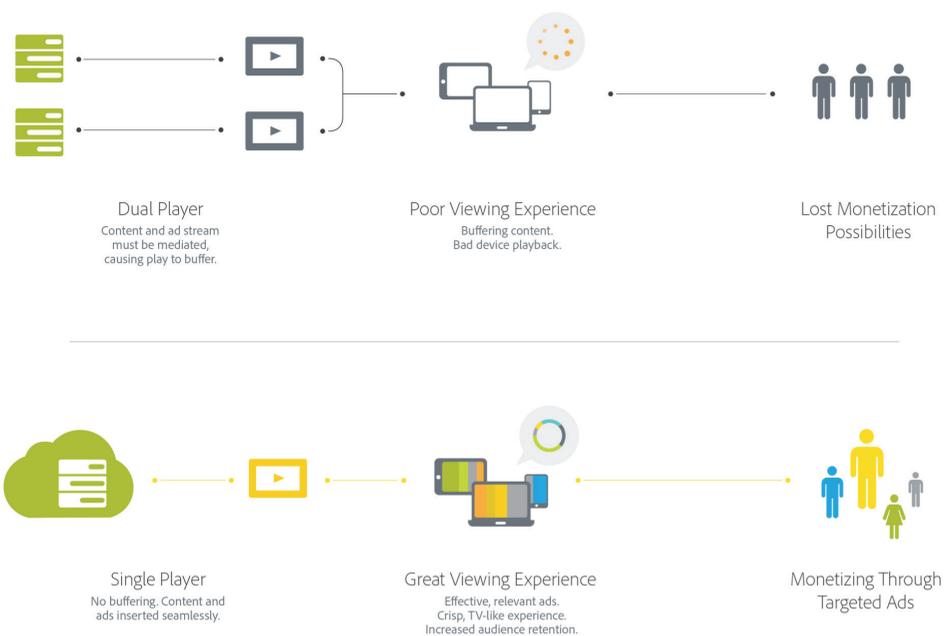


Figure 10: Dual-Player vs. Single-Player Approach

And for linear content, ad break execution must be frame-accurate, which cannot be achieved through existing dual-player technology. Without a capability like Primetime ad insertion, operators are forced to forgo revenue opportunities from advertising.

Adobe Primetime ad insertion enjoys seamless integration with the other capabilities of Adobe Primetime, including robust ad decisioning, QoE monitoring, and video analytics.

Adobe Primetime ad insertion enables operators to serve house promos or third-party ad network spots instead of showing a blank slate. Additionally, Adobe Primetime supports multiple stacked pre-roll, mid-roll, and post-roll ad calls.

Adobe Primetime

- ADOBE PRIMETIME SOLUTION OVERVIEW
- DEVELOPING WITH THE ADOBE PRIMETIME PLAYER SDK
- PUBLISHING WITH ENGAGEMENT IN MIND
- MONETIZING VIDEO CONTENT WITH ADVERTISING
- OPTIMIZING VIDEO STRATEGY WITH QOE MONITORING AND VIDEO ANALYTICS
- GLOSSARY OF TERMS AND ACRONYMS

Each portion of a linear commercial break (also known as an "ad pod") includes the advertiser's display or video creative shown within that commercial break. Each ad pod can be configured by:

- Duration of break (such as 60 seconds)
- Maximum duration of any one ad in the break (such as 45 seconds)
- Maximum number of ads in the break (such as two)

These pod parameters can be defined in advance, defined dynamically a few seconds before the break, or killed at any time.

Adobe Primetime can partition ad inventory and create rules for displaying video ads based on a complex set of parameters, including content metadata ingested by the system, device, domain, geography, or key values.

Inventory Management

Inventory management supports a strategic overview of target audience segments and how to optimize ad campaigns based on who they are and what they're watching.

With Adobe Primetime, inventory can be defined by ingesting metadata from multiple VCMSs to create a content library representing each channel, series, episode, and video asset. Operators can manage ad breaks and allocate inventory to TV Everywhere partners by using business rules that reflect existing partner agreements. Ad break inventory can be assigned as exclusive, by auction, or by percentage allocation.

Ad Routing

Adobe Primetime provides the capability to identify ad opportunities and route ad calls according to appropriate ad server-based inventory rules. All necessary targeting parameters are included in redirected calls.

The system supports industry-standard protocols, e.g., VAST and VMAP, for interoperability with third-party ad servers and ad networks, which is essential for supporting TV Everywhere initiatives. And viewers can be targeted dynamically through individual ad decisions to help maximize ad revenues.

Ad Stitching

The powerful ad stitching technology in Adobe Primetime provides a TV-like ad experience with seamless transitions between content and ads, and no buffering across desktop, mobile, or digital home devices. Both client- and server-side manifest stitching are supported.

Operators can identify commercial breaks using traditional broadcast ad break cues (e.g., SCTE 35), markers injected in real-time via a "big red button" interface, or ad timelines stored in the publisher's CMS. For maximum flexibility, the operator can also skip or replace burned-in advertisements based on viewing windows or regional advertisement agreements.

Ad Tracking & Reporting

Adobe Primetime supports IAB-compliant ad impression and ad progress tracking beacons to publisher and agency ad servers. And the system can generate historical reports and forecasts for available and monetized impressions, including insights into content attributes, viewer segments, and geographic viewership.

Adobe Primetime

- ADOBE PRIMETIME SOLUTION OVERVIEW
- DEVELOPING WITH THE ADOBE PRIMETIME PLAYER SDK
- PUBLISHING WITH ENGAGEMENT IN MIND
- MONETIZING VIDEO CONTENT WITH ADVERTISING
- OPTIMIZING VIDEO STRATEGY WITH QOE MONITORING AND VIDEO ANALYTICS
- GLOSSARY OF TERMS AND ACRONYMS

Optimizing Video Strategy with QoE Monitoring and Video Analytics

Overview

Adobe Primetime provides detailed video analytics to help operators gain insights about the experience and activities of their online audience. These capabilities rest on a service that collects video data with 10-second accuracy, formats video data to be handled like any other data, and enables video data to be analyzed and displayed in real-time.

Adobe Analytics was originally designed for tracking and analyzing data on website visitors. Adobe Primetime video analytics extends this service by capturing fine-grained data on online video quality and audiences in real-time. The resulting video data is then displayed via real-time dashboards that provide detailed Quality-of-Experience (QoE) monitoring.

Adobe Primetime provides rich metrics on the entire end-to-end performance of a video system from publishing, to delivery, to authentication, to playback. These metrics are reported to the operator in real-time through templated or custom dashboards. This helps operators to quickly identify the most profitable paths through digital assets, see where any visitors are navigating away, and identify the critical success metrics for online video distribution.



Figure 11: Adobe Primetime Data Foundation

As shown in Figure 11, QoE monitoring will include integrated views of data throughout the full cycle of experience from content origination and delivery to viewer entitlement validation and playback to engagement and ad decisioning and optimization. Adobe Primetime video analytics will allow that data to be available for deeper analysis with custom reporting and segmentation by video operations, marketing, and ad operations teams.

The data collection in Adobe video analytics serves as a pre-aggregation service for video content with Adobe Analytics. With no implementation changes or added development costs, the high-frequency data becomes available in Adobe Analytics. This provides highly granular reports, for the first time enabling precise engagement measurement at reasonable cost, along with all the benefits of the powerful segmentation and analysis tools of Adobe Analytics.

Design Philosophy

To deliver an effective consumer experience, operators need to collect real-time data throughout the video delivery process, drawing data both from the player and from any related upstream services. The more this data is sampled, the more complete a picture of the consumer experience can be derived; sampling video every 10 seconds provides a more accurate picture of an audience than 30- or 60-second samples.

Once collected, powerful analytics must be available to process and analyze the raw data. And the results must be available through data visualizations that are easy to scan, and customizable for an operator's preferences, as well as configurable thresholds for automated alerting. This data must be formatted so it can be integrated with the operator's existing data repository or partner-provided services to support additional strategic services.

The QoE monitoring and video analytics capabilities of Adobe Primetime have been designed to meet these goals, and provide consistent, accurate, and timely data to help operators make decisions that further their business goals.

Capability Highlights

Flexible real-time dashboards and reports

Operators can instantly create, customize, and distribute reports and dashboards in a variety of formats that can be viewed on desktops, mobile devices, and HD displays.

Single source of data

Adobe video analytics provides a single place to measure, report, and integrate data from content and ad performance across screens.

Actionable key performance indicators

Operators can see information on their key performance indicators (KPIs) including customer loyalty, drop-off rates, and visitor profiles, and use these insights to improve engagement.

Real-time intelligence

Adobe Primetime shows how the distribution and monetization initiatives of an operator are performing in real-time, so they can make any required corrections to improve engagement.

Universal viewer profiles

Operators can combine data on video viewing with data on application and website behavior to generate a universal consumer profile that supports more fine-grained segmentation and campaigns for their advertisers.

Accurate attribution

Operators can pinpoint the most successful ads, campaigns, channels, and paths to conversion to help make more-informed recommendations for their advertisers.

Adobe Primetime

- ADOBE PRIMETIME SOLUTION OVERVIEW
- DEVELOPING WITH THE ADOBE PRIMETIME PLAYER SDK
- PUBLISHING WITH ENGAGEMENT IN MIND
- MONETIZING VIDEO CONTENT WITH ADVERTISING
- OPTIMIZING VIDEO STRATEGY WITH QOE MONITORING AND VIDEO ANALYTICS
- GLOSSARY OF TERMS AND ACRONYMS

Adobe Video Analytics

Adobe Primetime video analytics collects highly granular data about video playback, providing high-accuracy video reporting, along with stream-based pricing for cost-effective results. In this way, Adobe Primetime makes collecting video analytics as simple as collecting content analytics. This is an industry first that benefits any operator seeking to optimize revenue and engagement from online video content.

Data is available within 10 seconds of playback and updated every 10 seconds to enable operators to troubleshoot any problems as they arise, and make rapid corrections.

This regular heartbeat design allows for standardizing Adobe's video analytics, delivering consistent key metrics across implementations for starts, completes, and time spent to derive the average minute audience metric.

This fundamentally changes Adobe Primetime video analytics, moving it toward an integrated data platform that drives higher-quality experiences, longer and deeper viewer engagement, and more effective monetization.

For example, Adobe Analytics can track visitors to an operator's website and record where they click through non-video content, while Adobe video analytics tracks what video content visitors watch and for how long. All this data can be integrated—and merged with further data sources if desired—to create a universal viewer profile with a richer, more comprehensive view of the subscriber.

These powerful capabilities help unlock and target high-value audiences using the most accurate methods. Operators can combine audience segments from first-party, second-party, and third-party data sources into high-value audience segments, and then use those to boost ad revenue.

The same real-time data used by the operations team is available in Adobe Analytics for deeper historical analysis. This creates an integrated database for real-time and historical data that eliminates the traditional data silos between operations and marketing teams.

Adobe Primetime QoE Monitoring

Adobe Primetime QoE monitoring gives operators an up-to-date snapshot of the current status of the entire video delivery system. This capability enables the collection of real-time analytics for video quality (e.g., bitrate, buffers, errors) and viewer engagement (e.g., concurrent audience, time spent).

Real-time dashboards in Adobe Primetime provide detailed metrics on audience engagement across content and ads, giving operators insight into who's watching and what's happening right now, which is especially valuable for live and linear content.

The real-time dashboards in Adobe Primetime display audience and ad impression metrics side by side, so that the operator can monitor QoS, engagement, and revenue in a single view.

QoE Overview Dashboard

As shown in Figure 12, the QoE Overview dashboard is designed to provide a quick snapshot of all the significant metrics for video delivery that contribute to an engaging viewing experience.

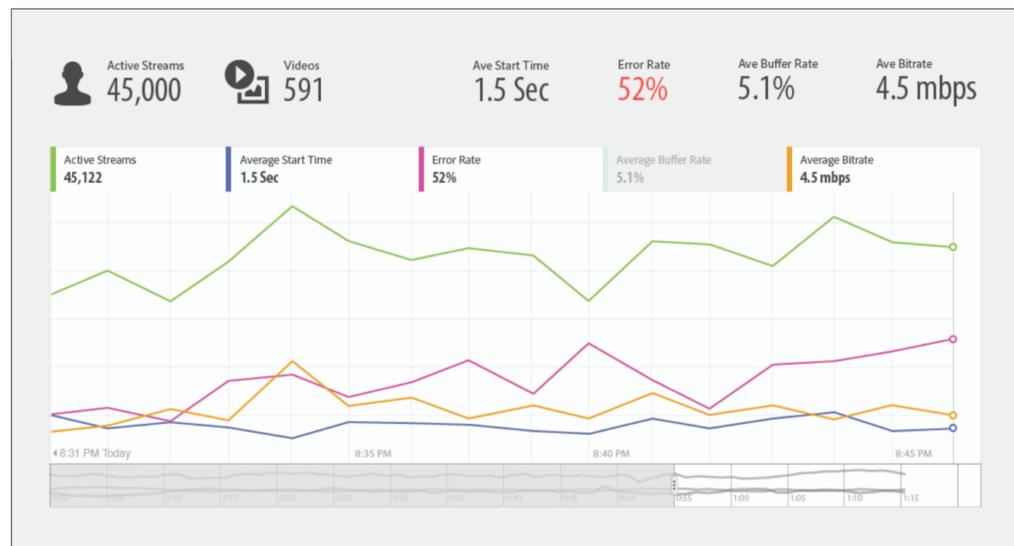


Figure 12: QoE Overview Dashboard

This dashboard shows the following metrics, both as numerals and as line graphs over time:

- Total number of active streams
- Total number of plays of any one video
- Average time to start rolling

Adobe Primetime

- ADOBE PRIMETIME SOLUTION OVERVIEW
- DEVELOPING WITH THE ADOBE PRIMETIME PLAYER SDK
- PUBLISHING WITH ENGAGEMENT IN MIND
- MONETIZING VIDEO CONTENT WITH ADVERTISING
- OPTIMIZING VIDEO STRATEGY WITH QOE MONITORING AND VIDEO ANALYTICS
- GLOSSARY OF TERMS AND ACRONYMS

Startup & Error Reporting Dashboard

As shown in Figure 13, the Startup & Error Reporting dashboard provides more detailed metrics on video startup and error conditions, for those who want to drill down into these issues. Playback error reporting is an off-the-shelf feature of the Adobe Primetime player SDK.

This dashboard shows the following metrics, both as numerals and as line graphs over time:

- Average startup time
- Total number of quits before video starts rolling
- Startup errors, total number and percentage of total plays
- Total number of playback errors
- Total number of app errors

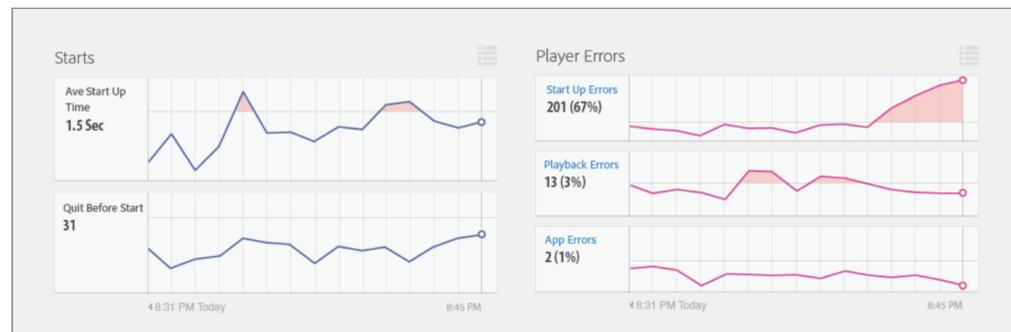


Figure 13: Startup & Error Reporting Dashboard

Buffers & Bitrates Dashboard

As shown in Figure 14, the Buffers & Bitrates dashboard provides more detailed metrics on video buffering and bitrates. This dashboard shows the following metrics, both as numerals and as line graphs over time:

- Average buffer rate
- Average bitrate of delivered video

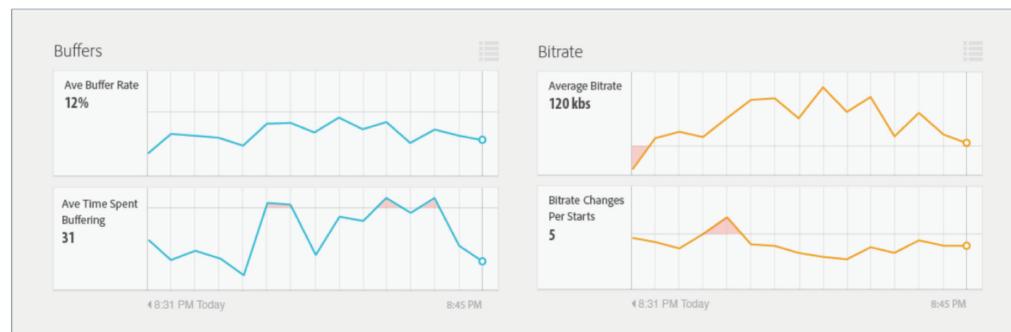


Figure 14: Buffers & Bitrates Dashboard

Geography Dashboard

As shown in Figure 15, the Geography dashboard shows where errors are taking place by geography. The left side of this dashboard shows a map of the U.S.A. with each state shaded from white to 100% red; the brighter the red, the more errors in that state. The right side of this dashboard shows a scrollable list of states, with the total number of streams and percent of total streams running in each state, and the total number and percentage of streams with errors in each state.

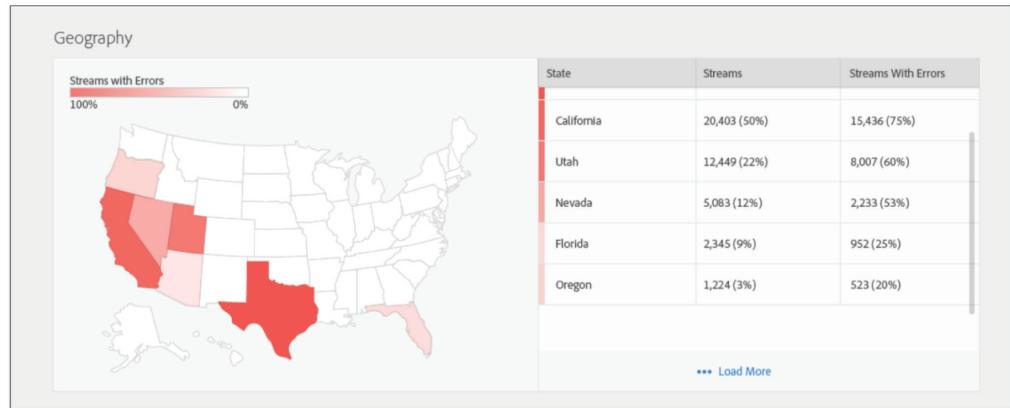


Figure 15: Geography Dashboard

Content Type & Device Breakdown Dashboard

As shown in Figure 16, the Content Type & Device Breakdown dashboard provides detailed metrics on the type of content running and the type of device being used to view it. This dashboard shows the following metrics as numbers, percentages, and bar graphs:

- Live, linear, and VOD streams, with and without errors
- Desktop, tablet, and phone devices, with and without errors

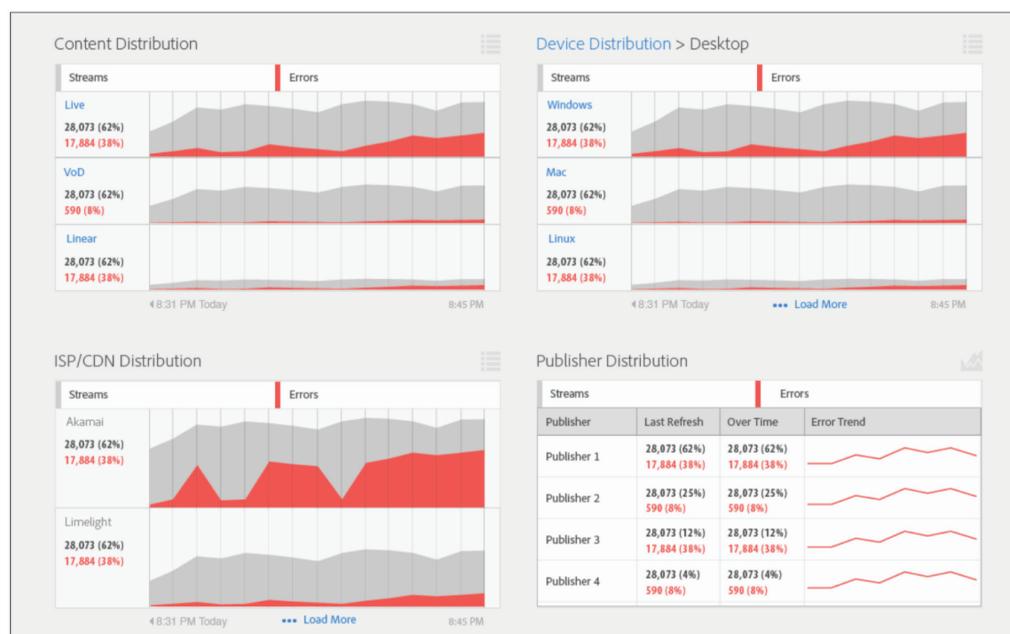


Figure 16: Content Type & Device Breakdown Dashboard

Glossary of Terms and Acronyms

ADM: Ad Management

Application (or app): The software running on the consumer's desktop, mobile or digital home device (same as client)

C3: An audience metric created by Nielsen that measures the ratings for average commercial minutes in live programming plus three days of DVR playback to allow for timeshifting

CATV: Cable Television (a type of operator)

CDN: Content Distribution Network

CEA 608/708: Two standards for closed captioning; CEA-608 is an older spec for NTSC while CEA-708 is for DTV

CLEC: Competitive Local Exchange Carrier (a type of operator)

Client: The software running on the consumer's desktop, mobile or digital home device (same as application)

CMS: Content Management System, normally used for static webpage content

CPC: Cost Per Click

CPM: Cost per thousand impressions, a common way to sell packages of online advertising

Customer: The operator using the Adobe Primetime system

CVAA: Communications and Video Accessibility Act

DASH: Dynamic Adaptive Streaming over HTTP

DBS: Direct-Broadcast Satellite (a type of operator)

DECE: Digital Entertainment Content Ecosystem

Developer: The software developer working for the operator

DMP: Data Management Platform

DRM: Digital Rights Management

DVR: Digital Video Recorder

DTV: Digital TV

DXVA: DirectX Video Acceleration

HD: High Definition

HDCP: High-bandwidth Digital Content Protection, a form of copy protection developed by Intel Corporation for digital content

HDS: HTTP Dynamic Streaming

HLS: HTTP Live Streaming, a format used by Apple to stream video to iOS devices like the iPhone and iPad

IAB: Interactive Advertising Bureau

IPTV: Internet Protocol TV (different from smart TV)

M3U8: A file format for digital playlists. M3U is the original plain-text ASCII format, while M3U8 uses UTF-8 Unicode characters. M3U and M3U8 files are the basis for the HLS format used for streaming video by Apple.

MBR: Multiple BitRate

MRC: Media Rating Council

MSO: Multiple System Operator, a collective term for all operators

MVPD: Multi-channel Video Programming Distributor, commonly called "operator"

Operator: A collective term for multichannel video programming distributors (MVPDs), Multiple System Operators (MSOs), pay-TV operators, satellite providers and telecommunications companies (telcos)

OVP: Online Video Platform

Partner: A business partner within the online video ecosystem that provides goods or services to the operator

PHDS: Protected HTTP Dynamic Streaming

PHLS: Protected HTTP Live Streaming

Programmer: A collective term for the entities that organize and broadcast content (e.g., NBC Universal).

QoE: Quality of Experience, a measurement that provides a more holistic view than basic QoS

QoS: Quality of Service, a measurement of the quality of the video stream delivery

REST: Representational State Transfer, an architecture for distributed hypermedia networks such as the web and the most popular web API design model

RTMP: Real Time Messaging Protocol

SAS 70: Statement on Auditing Standards No. 70 for Service Organizations is a widely recognized auditing standard developed by the American Institute of Certified Public Accountants (AICPA) for web services

SCTE 35: Society of Cable Telecommunication Engineers 35 2007, an ANSI standard that defines the cue messages embedded in the transport stream, the upcoming splice points, and other timing information.

Smart TV: A TV that can connect to the Internet

SSO: Single Sign-On

SSL: Secure Sockets Layer, a protocol for encryption that uses a public key to ensure the identity of the remote party

STB: Set-top box

TVE: TV Everywhere

VAST: Video Ad Serving Template, an IAB standard for a universal XML schema for video ads

VCMS: Video Content Management System, used for online video content

VMAP: Video Multiple Ad Playlist, an IAB standard for ad playlists

VPAID: Video Player Ad-Serving Interface Definition, an IAB standard for an interface between video players and ad units

WebVTT: Web Video Text Tracks, a standard for closed captioning



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