Dynamic Ad Insertion for compressed video or SCTE 104 (for SDI video) standard cues. When a consumer requests a particular video stream, the program is requested from the server. It is then streamed on the fly at the point of request. Pre-packaging content being pre-packaged for each delivery format, just-in-time packaging takes the content one step further. This approach allows for reduced latency and integrates the ad content into the video stream, ensuring that the user experience is not compromised. There is also a greater chance of the advertisement being seen by the consumer, as it is placed at the optimal point in the stream.

Latency is a significant concern in streaming media, and just-in-time packaging helps mitigate this issue. Unlike client-side ad insertion, where ads are inserted at the client level and can disrupt the user experience, just-in-time packaging ensures that the ads are inserted seamlessly and do not affect the playback of the video stream. This is particularly important in sports broadcasting, where the length of program breaks is not always known in advance. Just-in-time packaging allows for dynamic ad insertion, where ads are inserted at the optimal point in the stream, ensuring that they are seen by the audience.

Using the hybrid solution, SSAI can be used for streaming platforms such as FireTV, Roku, Chromecast, etcetera, where CSAI solution is very difficult to implement. This approach allows for the integration of ads into the video stream without compromising on the user experience. Just-in-time packaging also reduces development time, as it eliminates the need for the development of multiple ad insertion solutions for different delivery formats. This approach is also scalable, as it can handle the load on CDN-like load for delivering the content.

In order to maximize returns on advertising, a hybrid solution that combines the best of DAI, SSAI, and CSAI is necessary. This approach allows for the integration of ads into the video stream without compromising on the user experience. Just-in-time packaging also reduces development time, as it eliminates the need for the development of multiple ad insertion solutions for different delivery formats. This approach is also scalable, as it can handle the load on CDN-like load for delivering the content.
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What’s Next in Video Advertising?

The surge in demand for OTT and mobile video consumption combined with the erosion of Pay TV subscribers has created an opportunistic moment for video service providers and advertisers. Eyeballs have migrated to OTT and mobile with enough demand to rival television, creating an open window of time to reach these valuable audiences. Key insights from OTT and mobile data help inform advertisements for a better ROI than what television can offer. In fact, OTT ads are reporting a 97% completion rate and 100% viewability\(^1\).

Benefits to OTT and mobile advertising include targeting specific audiences based on demographic and behavioral traits as well as using dynamic ad insertion to personalize the ads. Data collected from viewing habits is collected and analyzed to better inform which advertisement should be displayed. There are additional advantages to advertisements informed through cross-device data, which is collected when OTT devices are linked to mobile devices, tablets, smart TVs, and other devices.

Connected TV on The Rise

This paper discusses how dynamic ad insertion solves OTT service providers’ two biggest concerns: it improves the user experience and increases revenue. Dynamic ad insertion is discussed in detail including client-side ad insertion and server-side ad insertion, and why a combination of both is the best approach for today’s audiences. This paper also discusses Hybrid DAI architectures, which combine modern CSAI with SSAI, to handle demand at scale while offering price efficiency.

For advertisers, connected TVs are the best of both worlds. On one hand, connected TVs have the same targeting capabilities and dynamic ad insertion as that on mobile, but with higher viewability and completion rates. Viewability or viewing experience on mobile falters when display resolution is not optimized to specific screen size with many ads displayed below the fold.

Due to the benefits of connected TV advertising, the ad-serving company AppNexus saw a 748% year-over-year rise in connected TV ad sales\(^2\). Roku may be the year’s biggest success story with an ad-supported strategy that saw 6.7 billion hours streamed with 43% ad supported. In fact, in Q2 2018 Roku’s ad-driven platform grew 96% to $90.3 million in the same year QoQ\(^3\).

Dynamic Ad Insertion: Higher Completion Rates and Increased Transparency

Dynamic Ad Insertion (DAI) is a key driver to the growing trend for by offering a technology that allows advertisers to exchange ad creatives based on the unique demographics and behaviors of the person viewing the ad.

By delivering real-time campaigns for linear, live or video-on-demand content, both advertisers and publishers are able to maximize returns in ways that cannot be accomplished through Pay-TV or mobile alone. This is why some OTT ads see a 97% completion rate and 100% viewability – it combines the audience targeting precision of mobile with the user experience found on Pay TV.

DAI is a method of delivering targeted ads that are “dynamically” inserted from the server across various platforms, such as mobile devices, tablets, smart TVs, Roku players, Amazon Fire TV, Chromecast, laptops, desktop computers and more. This allows the ad creative to


change in real-time, and is a significant improvement from mobile, which was dependent on SDKs installed on the client side that interrupts the user experience when an ad is inserted. DAI also offers consistent quality with a single, uninterrupted stream that contains both program and commercial content.

Below, we examine architectures required to achieve Client-Side Ad Insertion (CSAI) and Server-side Ad Insertion (SSAI) at scale so that thousands or perhaps millions of concurrent, individually-tailored advertising manifests can be delivered in real-time – even for live streaming events or sports. To achieve this scale, cloud and cloud-assisted software solutions are required.

**Overview of Key Benefits to DAI:**

Today's content comes from an array of broadcasters, niche content companies, and OTT platforms. Whether the content comes from NBC, CBS, Sky Media, Hulu, or Roku, there are two key issues that drive operational decisions: a high-quality experience and increased revenue. DAI helps both of these operational priorities.

- **Advertisements with TV-like Quality:** Traditional video advertising uses overlaying concepts or player switching technologies, which created disruption in viewing experiences while switching between content and the ad. With DAI, ads transition seamlessly because the ads are inserted at the server level, which delivers a continuous stream for enhanced TV-like quality.

- **Video Centric:** Mobile has become the primary method for viewing video. 75% of global video is viewed on mobile. Nearly 2.4 billion people will watch video content in 2018, which is double from 2014. Ad insertion can overcome ad blockers on all platforms. DAI is favorable on mobile compared to traditional advertising, which compromises the viewing experience and can trigger ad-blocking software due to content and advertising coming from two different sources. Due to seamless delivery for DAI, ad-blocking software is less likely to be triggered.

- **Increase Revenue with Personalization:** Traditional linear TV models do not have targeting capabilities, rather they use broad methods based on programming to guess demographics, or they use geographies. There is no competitive advantage to

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traditional linear models as advertisers are not confident they are reaching the correct audience. DAI is necessary to remain competitive and to attract advertisers by targeting on an individual level. DAI also provides advertisers with transparent reporting capabilities on ad metrics.

- **Competing with Subscription Video on Demand:** Ad-supported OTT providers face competition from subscription-based competitors. SVOD requires massive investments in original content and marketing costs to secure monthly subscription fees. Advertising is appealing for OTT content providers because it is easier to attract audiences to free content. Server-Side Ad Insertion (SSAI) can insert targeted advertising into individual video delivery paths while still providing transparent metrics when used together with client SDK for Ad Tracking.

### Analyzing the Benefits of CSAI and SSAI

#### Advantages of CSAI:

Client-Side Ad Insertion has been the ongoing standard for inserting video ads into a video stream. CSAI has some key benefits which are important to discuss. For instance, CSAI has superior metrics because the advertiser can monitor the metrics directly through the SDK. Most current ad technologies, such as viewability, interactivity, and click-throughs, are built on the client-side. Another significant advantage to CSAI is the ability to serve VPAID Ads.

#### Disadvantages of CSAI:

As video ecosystems continue to evolve, issues have arisen when relying on the video player or the device to combine the ad with the content. For instance, there can be an excessive amount of latency and buffering if the ad-serving system is slow or the device has poor broadband access. CSAI is particularly unforgiving with live broadcasts, such as sports or news programming.

Ad-blockers can easily detect CSAI while malware can corrupt ad calls and insert competing advertisements. In addition, multi-platform support is challenging for client-side apps, and the apps are dependent on ad ecosystem components because they are client-side, which makes them hard to switch out.

#### CSAI Architecture:

Early attempts at online video advertising had the commercial spot “burnt in” to the video asset. This so-called static advertising did not take demographics into consideration and was always attached to specific content long after an on-air campaign has ended. Due to drawbacks of “burn in” commercials into video assets, online services moved to a client-side model which inserted specific, relevant advertising into the video stream at the point of playback. This ensured that the commercials were appropriately targeted and timely, because the commercial could be changed for each viewing.

This approach offers two main benefits. The first is that the CPM (cost per thousand impressions) is higher than with static advertisements because the demographics are better identified. But that is not all: end users find a personalized advertisement less intrusive because it offers something more in line with their interests. A luxury car fan will be much more interested in an ad from BMW or Mercedes-Benz than a generic soda or grocery store spot.

The established standard for this is VAST (video ad serving template), published by the Interactive Advertising Bureau (IAB). The fundamental architecture of client-side advertising provision is shown in figure 1.
Advantages to SSAI:

Server-side ad insertion, also known as “ad stitching,” is a superior choice for live programming, simulcast and linear programming. The user experience with SSAI is improved by having one continuous stream of content when alternating between content and ads. Latency is also reduced. There is also a greater chance of the advertisement reaching the viewer with SSAI as advertisements are inserted in the video stream at the point of delivery, and this opens up real-time bidding through programmatic technology.

Disadvantages to SSAI:

SSAI may not be very advantageous for a small publisher who has limited video inventory. SSAI alone does not support Clickable/Interactive/VPAID Ads. It needs support from SDKs to build such features. VAST 4.1 standard overcomes most of the challenges. For example, it has segregated out Linear Video parts and Interactive parts of an ad. In VAST 4.1, IAB has officially depreciated VPAID format. Text ad industry will take some time to accept these changes, until then VPAID ads will continue to be part of the ad industry.

SSAI Architecture

Server-side advertising insertion (SSAI) is reminiscent of traditional TV advertising because both content and commercials arrive in a single stream from a single source. The difference with SSAI is that the advertising is no longer static, and is dynamically inserted prior to delivery to a video player.

SSAI requires an architecture that supports just-in-time packaging of content. Rather than content being pre-packaged for each delivery format, just-in-time packaging takes the native content from both the program store and the advertising servers, and adapts it on the fly at the point of request.

In this architecture (see figure 2), the manifest remains with the service provider. When a consumer requests a particular video stream, the program is requested from the server. It arrives complete with markers for commercial insertion, usually in the form of SCTE 35 (for compressed video) or SCTE 104 (for SDI video) standard cues.
In contrast to CSAI in which the receiving device makes calls to the advertising servers and provides the response for the impression count, in the SSAI model, the video delivery platform makes VAST calls with end-user metrics to the advertising servers and receives the appropriate commercials. These are cut into the video upstream of encoding or transcoding.

This architecture allows for the dynamic insertion of advertising into live streams, and even into sports broadcasts when it is not known in advance how long a program break will be. By using the same SCTE 104 or SCTE 35 cues that broadcast playout systems use, a server-side advertising insertion platform can perfectly fill the break on the fly.

Hybrid Solution: Best of Both CSAI and SSAI

In order to maximize returns on advertising, a hybrid solution that combines the best of SSAI with the best of CSAI is ideal. SSAI brings in smooth TV-like experience across a multitude of devices and platforms. CSAI requires more developmental efforts of building and integrating SDKs, yet it gives very accurate ad tracking metrics and covers more ad formats.

The result of combining CSAI with SSAI in a hybrid solution, such as ExpressPlay’s Dynamic Ad Insertion, is a price effective ad personalization and monetization solution across devices and platforms that does not compromise on user experience and also reduces developmental/integrational efforts that does not compromise user experience and reduces development time.

Using the hybrid solution, SSAI can be used for streaming platforms such as FireTV, AppleTV, Roku, Chromecast, etcetera, where CSAI solution is very difficult to implement. SSAI and CSAI can be used in conjunction with mobile devices, tablets, laptops and desktops to get both a TV-like experience and accurate ad metrics.
Solving for Scalability

Supporting the various devices and platforms used globally is critical for scale. This is further complicated when attempting to live stream as the content delivery has to scale for massive global throughput to ensure millions of users can watch the events at the same time. During major sporting events, for instance, high availability is essential for service providers. Complete, end-to-end content protection including global coverage, device credentials, content key storage, rights compliance, watermarking, among other things, is essential for successful OTT live events and live sports delivery.

SSAI depends on real-time delivery. The content is stored in a high-quality delivery format, and packaged for delivery at the time it is requested. Benefits to this method include reduction of storage and bandwidth costs by delivering content best-suited to network conditions, and the target device, at the moment of delivery. CSAI utilizes the benefits of VPAID and VAST, when needed, while also allowing for real-time ad insertion.

For dynamic server-side advertising insertion, the best place to prepare content is at the edge, and as close to the consumer as possible. The hybrid solution, that combines CSAI and SSAI, provides best viewing experiences when leveraging the same edge, and as close to the consumer as possible.

Scalability requires architecture that is able to handle CDN-like load for delivering the manipulated manifests. This manifest manipulation depends on multiple factors like ad campaigns, viewer’s interests, ad media’s transcoding and segmenting. A scalable solution should address the need to ensure uniqueness of stream for individual viewer, manipulation of manifests for client-side insertion and complexities of live stream whereby spike of ad requests come from simultaneous viewers.

When The ATD Gets Overloaded Many Ad Slots Go Unfilled
Standards

The most common video streaming formats across the internet are Apple’s HLS and MPEG’s DASH. Other formats are Adobe’s HDS and Microsoft’s Smooth Streaming, but its usage is rapidly declining. HLS and DASH are emerging as the most widely used adaptive streaming formats.

The working principal behind HLS and DASH is the same. The video content is sliced down into smaller video pieces. These pieces are downloaded and played in a sequential order defined by the playlist or manifests. To overcome the uneven bandwidth, streams are delivered with multiple bitrate and resolution combinations. Therefore, if the bandwidth is weak, the stream automatically adjusts to a lower bitrate. If the bandwidth is strong, the stream jumps to a higher available bitrate.

Intertrust ExpressPlay Ads – Hybrid Solution for Dynamic Ad Insertion

ExpressPlay Ads offers content monetization, ad targeting, security and viewability in one integrated media solution to help broadcasters and OTT companies earn more revenue while still maintaining a TV-like experience. We offer dynamic ad insertion that combines CSAI and SSAI in one hybrid solution, while still keeping content secured through digital rights management (DRM) and card-less conditional access (CAS).

Online & Offline Ads

ExpressPlay Ads communicates to all popular Ad Servers like Google Ads (DFP), SpotX, FreeWheel. We can also make custom integration with a DSP (Demand Side Platform) behind our Ad Exchange. We support various Ad Formats like VAST, VMAP, Interactive Ads, MRAID through the combination of SSAI and CSAI.

ExpressPlay Ads supports ad delivery to devices that enable the offline viewing of content, as well. Our offline ad delivery system offers an end-to-end solution including delivering accurate ad metrics. This has become particularly useful for offline content delivery systems, like Kiora, which are built for limited broadband situations such as In-Flight Entertainment, In-Vehicle Entertainment and rural regions. In offline systems, streaming happens over Wi-Fi and content is regularly updated when internet connectivity is available. ExpressPlay Ads offers monetization solutions for limited broadband environments while still providing accurate ad metrics.

Digital Rights Management

With OTT becoming the mainstream video delivery media, deploying DRM is how to future-proof your content protection. As the inventor of DRM, Intertrust delivers a solution that is cost effective, can be seamlessly upgraded to scale, and is compatible with every major DRM system on the market today.

Conditional Access

ExpressPlay CAS offers a disruptive, card-less conditional access system (CAS) that uses open standard Marlin DRM to let broadcasters and network operators deliver content to a set-top-box (STB) or smart TV via DVB (digital video broadcasting) channels. It requires no dedicated hardware in devices or external modules such as conditional access modules (CAM) and supports both DVB broadcast-only devices, broadband, and hybrid broadcast and broadband devices.
Conclusion

Video consumption across audiences continues to reach staggering numbers with 9 billion mobile subscribers worldwide and 75% of worldwide viewing taking place on mobile. However, the next great growth story is coming from over-the-top entertainment, which is experiencing double-digit growth globally with an estimated 765 million people using a over-the-top service. Advertisers must reach these audiences regardless of the platform or device being used, the format of video – whether it’s linear, live or playback, and regardless of broadband connection strength. It’s important to have a hybrid, flexible solution that supports the future of both mobile and OTT video streaming. ExpressPlay Ads is uniquely positioned to capture audiences globally with CSAI and SSAI methods, for online and offline content, with additional features such as DRM and CAS to help secure and scale your media integration.

ExpressPlay Ads Summary of Feature and Benefits:

**Targeted ad delivery** – While most broadcasters rely on crude statistical methods to select which ads to play to an entire audience, ExpressPlay Ads ensures that each viewer will get the ad most suitable for his or her audience profile.

**Monetize premium content cost effectively** – With billions of devices profiled worldwide, ExpressPlay Ads enables advertisers to leverage deep audience insights for nuanced ad targeting. By creating more valuable fine-grained audience segments, broadcasters can benefit from higher CPMs and an improved viewer experience.

**Seamless streams on any screen** – ExpressPlay Ads provides viewers a seamless TV-like experience whether it is on mobile, browser, or OTT video. ExpressPlay Ads supports ad insertion in any content, including VOD content, live streams, linear, and Catch-up TV. Ads can be inserted into DRM-protected content with no need for third-party servers or ad insertion technologies.

**Monetization of long-tail content** – ExpressPlay Ads creates new long-tail opportunities for overlooked and undervalued TV content. Because ExpressPlay Ads allows for greater precision in targeting, we can help you monetize content no matter how small or niche the audience.

**Advanced ad insertion technology** – ExpressPlay Ads supports both server-side and client-side ad insertion (SSAI & CSAI capabilities). While our client side solution allows for interactive ads and provides accurate ad metrics, our server-side solution works with any client player and acts as an effective antidote to ad blockers.

**Viewability** – ExpressPlay Ads provides viewability metrics, which the operator may share with programmers as proof that their ads were delivered and viewed.

**Pair Ads with ExpressPlay Audience™** – Integrate Ads seamlessly with ExpressPlay Audience, our trusted Data Management Platform (DMP) for broadcast audiences. Broadcasters can onboard and manage audience data securely, protecting sensitive data and ensuring user privacy.

**Audience™** – transforms your audience data and log files into actionable information. We do this by providing on-premise deployment that seamlessly integrates into your existing workflow, offering audience intelligence and new insights.

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In this architecture (see figure 2), the manifest remains with the service provider. When a SSAI requires an architecture that supports just-in-time packaging of content. Rather than reaching the viewer with SSAI as advertisements are inserted in the video stream at the programming, simulcast and linear programming. The user experience with SSAI is Server-side ad insertion, also known as “ad stitching,” is a superior choice for live formats.

Advantages to SSAI:

Disadvantages to SSAI:

For dynamic server-side advertising insertion, the best place to prepare content is at the desktops to get both a TV-like experience and accurate ad metrics. The result of combining CSAI with SSAI in a hybrid solution, such as ExpressPlay’s Dynamic SDKs, yet it gives very accurate ad tracking metrics and covers more ad providers. Complete, end-to-end content protection including global coverage, device credentials, content key storage, rights compliance, watermarking, among other things, is a change in real-time, and is a significant improvement from mobile, which was dependent on client SDK for Ad Tracking. It is appealing for OTT content providers because it is easier to attract audiences to free audience. DAI is necessary to remain competitive and to attract advertisers by targeting traditional linear models as advertisers are not confident they are reaching the correct platforms. DAI helps both of these operational priorities.

Benefits to OTT and mobile advertising include targeting specific audiences based on rapid declining. HLS and DASH are emerging as the most widely used adaptive streaming formats. Other formats are Adobe’s HDS and Microsoft’s Smooth Streaming, but its usage is rapidly declining. The most common video streaming formats across the internet are Apple’s HLS and MPEG’s DASH. The surge in demand for OTT and mobile video consumption combined with the erosion of poor broadband access. CSAI is particularly unforgiving with live broadcasts, such as sports as video ecosystems continue to evolve, issues have arisen when relying on the video platform and advertising coming from two different sources. Due to seamless delivery compromises the viewing experience and can trigger ad-blocking software due to change in real-time, and is a significant improvement from mobile, which was dependent on client SDK for Ad Tracking.

• Increase Revenue with Personalization:

Video Centric:

Intertrust provides trusted computing products and services to leading global corporations – from mobile and CE manufacturers and service providers to enterprise software platform companies. These products include the world’s leading digital rights management, software tamper resistance and privacy-driven data platforms for software tamper resistance and private data sets for various verticals including energy, entertainment, fintech, healthcare, and IoT.

Founded in 1990, Intertrust is headquartered in Silicon Valley, with regional offices in London, Tokyo, Mumbai, Beijing, Seoul, Riga, and Tallinn. The company has a legacy of invention, and its fundamental contributions in the areas of computer security and digital trust are globally recognized. Intertrust holds hundreds of patents that are key to Internet security, trust, and privacy management components of operating systems, trusted mobile code and networked operating environments, web services, and cloud computing.

Additional information is available at intertrust.com, or follow us on Twitter or LinkedIn.