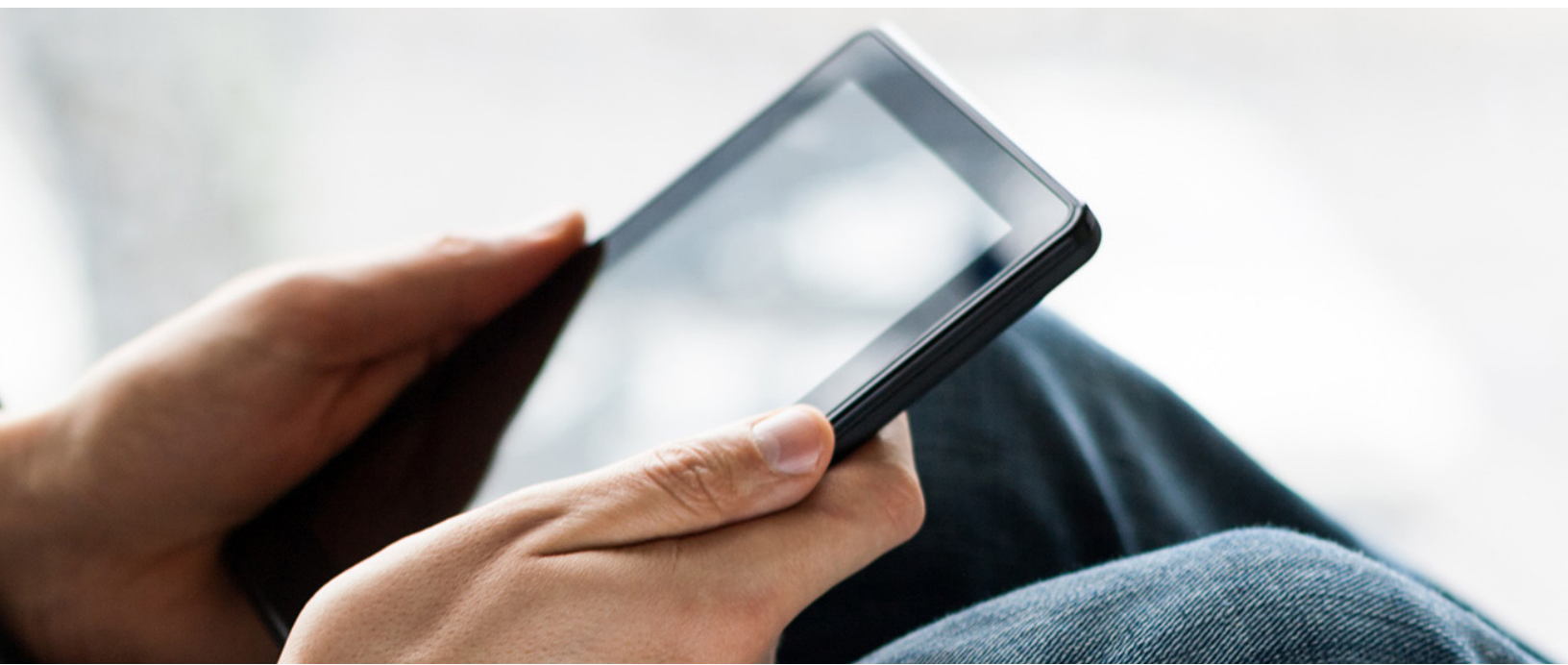




# Whitepaper

## Moving to HTML5 Video



chrome

# Executive Summary

Web and mobile video is growing rapidly, with [watch time increasing by 60%](#) year-on-year. As demand increases, the underlying technology is also developing rapidly. For many top media sites, HTML5 video has now replaced Flash as the preferred platform for web and mobile delivery.

HTML5 video is a proven technology with [billions of hours](#) of content delivered monthly and a large and thriving ecosystem. Recent HTML5 video technology advances make it a fully-featured platform, allowing full custom player control, digital rights management (DRM), and adaptive bitrate streaming support for both on-demand and live video.

*Major Media Sites are Moving to HTML5*

[YouTube](#), [Netflix](#), [Amazon](#), [Facebook](#), [BBC](#), [New York Times](#) and other major media properties today deliver video with HTML5.

As users move to the mobile web, the use of Flash Player is decreasing. Content publishers are strongly encouraged to transition to HTML5 video to broaden their reach and improve user experience.

## Moving to HTML5 Video: Key Steps



- Video Player:** Select and customize
- Web Page:** Translate from Flash to HTML5
- Ads Platform:** Convert to HTML5
- Media:** Transform to HTML5-friendly formats
- DRM:** Encrypt premium content, select technologies

HTML5 offers clear advantages, but executing an HTML5 transition can take several months. Content publishers should analyze their needs and make a future-proof plan quickly. The sooner a publisher transitions, the sooner they can realize the cost savings, longer watch times and improved user experience of HTML5 video.

## HTML5 video has several advantages over Flash:

### Less Complexity

Create a single player solution and experience for desktop and mobile web

### Happier Viewers

A better user experience with faster page loads and shorter start times

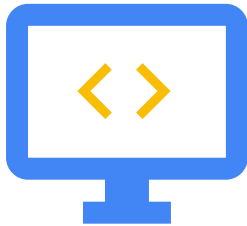
### More Power

Reduced battery consumption on laptops with native playback support

### Lower Costs

When using advanced codecs, lower distribution and storage costs

2007



2016

## Facts

### HTML5 video...

- is supported by billions of mobile, desktop and connected devices
- allows content protection (DRM) and adaptive streaming
- delivers a [superior user experience to Flash](#)
- streams billions of hours of media every month

## History

### Pre-2007

- Web video playback required browser plugins
- Users must download plugin to watch video
- Publishers must support multiple plugin versions

### 2007

- HTML5 <video> tag introduced
- Audio and video become first-class web citizens
- Native video implementations in browsers
- No features for DRM, adaptive streaming
- Limited device and format support

### Today

- Flash use is declining, and not supported on mobile
- Users are migrating to mobile
- Mobile watch times are [increasing by 100% per year](#)
- [Broad device support](#) with billions of end points
- DRM and adaptive streaming technology available
- HTML5 video is a viable platform for premium content
- Major sites ([Amazon](#), [Facebook](#), [Netflix](#), YouTube) switch to HTML5 video

## Key Technologies

HTML5 video is enabled through browser support for video and audio playback, Javascript extensions to control that playback, and ecosystem support for critical functions such as content protection and advertising. This section provides more detail on key HTML5 technologies.

### Key Technology: Player Control

The addition of Media Source Extensions (MSE) gives HTML5 video developers control over how media data is delivered to the browser using Javascript. MSE allows your web site to offer smooth playback, adapting to changes in a viewer's available bandwidth by streaming different bit rates. This technique is called adaptive bitrate streaming and is enabled by media formats such as MPEG-DASH.

MSE is [widely supported by mobile and desktop browsers](#), and adaptive bitrate streaming via MSE is enabled by a variety of player technologies.

HTML5 also offers full-screen viewing, customized player experiences, and timed text (caption) display, giving a complete video experience.



### Takeaway:

*HTML5 gives you a fully customizable viewer experience, with support for adaptive bitrate formats.*



### Key Technology: Content Protection

The addition of Encrypted Media Extensions (EME) to HTML5 video provides digital rights management (DRM) capabilities. This is particularly important for premium content publishers who require that their video be protected. Three key considerations when planning an HTML5 transition include content encryption, DRM system support, and user authentication.

**Content Encryption:** EME allows reuse of encrypted assets across many HTML5 platforms. Specifically, HTML5 video can be encrypted once using the ISO BMFF/CENC format and streamed to many browser, mobile, and CE platforms, saving critical asset storage and maintenance costs.

**DRM System Support:** Browsers and devices supporting EME generally each only support one DRM system. Microsoft Edge and Internet Explorer support Playready; Safari on OS X supports Fairplay; Chrome, Opera and Android WebView support Widevine; Firefox supports Adobe Access. While EME does allow common media encoding and encryption across many of those platforms, publishers will need to support multiple DRM systems to reach these platforms, or work with a service provider that can manage multiple DRM systems for them.

**User Authentication:** For publishers using authentication products such as Adobe Primetime, they will still be able to [authenticate access with a single toolkit](#), while supporting DRM for each browser platform.



### Takeaway:

*HTML5 allows full digital rights management across most major browsers; publishers will need to support multiple DRM systems to ensure full HTML5 DRM support.*

### Key Technology: Next-Generation Video Compression

HTML5 video supports next-generation video compression, reducing operating costs and improving viewer experience. When using the VP9 codec, video bit rates can be [reduced as much as 45%](#) compared to H.264. This in turn can help reduce transmission costs, and improve video quality. User experience is also improved by VP9, allowing video playback to start 15–80% faster as well as enabling users with lower bandwidth to watch higher quality video.

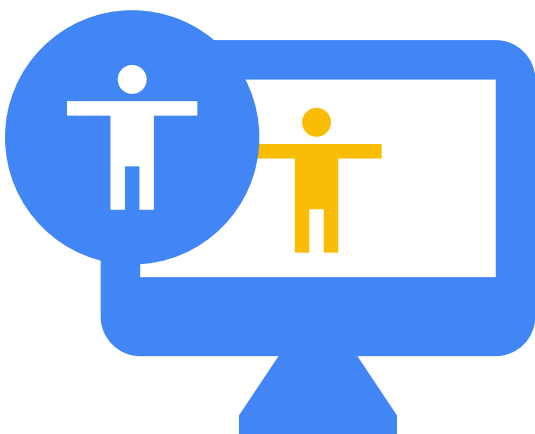
While most browsers support H.264 decoding today, the newer VP9 codec also has broad support including Chrome, Firefox, Opera, and ([coming soon](#)) Microsoft Edge. All told, VP9 can be decoded by over two billion end points.

Content providers don't have to pick a single compression format, because simple HTML5 calls can detect what codecs are supported in each session. This allows providers to prepare multiple compression formats, allowing the player to pick the best one for each user, resulting in an improved experience. Content providers who wish to reduce costs and improve viewer experience should consider adding VP9 video compression as an available format.



#### **Takeaway:**

*HTML5 enables use of next-generation video compression, improving viewer experience and lowering costs.*



### Key Technology: Video Advertising

HTML5 video is starting to replace Flash within advertising. HTML5 supports [VPAID 2.0](#) (a common interface between players and ad units), which allows interactive video ads without the use of Flash. Most players and ad platforms now support VPAID 2.0 creatives, making HTML5 fully capable of serving video ads. Leading ad creation, reporting and verification tools have also added support for HTML5, and HTML5 offers a single platform that can work on mobile and desktop browsers.

This is good news for users. HTML5 does not load a plugin, and advanced codecs can also result in faster playback. HTML5 start times can be [15–80 percent](#) faster than Flash. For ad-supported content this reduces viewer wait times and increases engagement.

This is also good news for ad creatives. HTML5 ads have more reach because they can be displayed in both mobile and desktop browsers — meaning one ad unit can run across multiple devices. Creating HTML5-based video ads requires creatives to change their process for submission, but the tools for creating HTML5 ads are [available](#) and many are actually the same tools creatives [are already using for Flash](#).

For publishers, this means that the ad ecosystem is moving to HTML5 video. Major media properties such as YouTube [require videos compatible with HTML5](#). As creatives move towards HTML5-based ads, publishers should have a plan for their HTML5 video migration to avoid disrupting ad-supported revenue.



#### **Takeaway:**

*Video advertising tools, players, and platforms are ready. With support for mobile, HTML5 ads have greater reach than Flash. As ad platforms stop accepting Flash, creatives will move to HTML5.*



# Device and Browser Support

All major browsers now support HTML5 video, and many support next-generation video compression as well. The following table lists key browsers and their support for HTML5 features:

Browser	MSE		EME		VP9 Browser Support
	Browser Version	Container Supported	Browser Version	DRM Supported	
Firefox (Desktop)	<a href="#">42+</a>	<a href="#">mp4, WebM</a>	<a href="#">38+</a> (Windows)	<a href="#">Adobe</a>	<a href="#">28+</a>
Chrome (Desktop)	<a href="#">23+</a>	mp4, WebM	<a href="#">42+</a>	Widevine	<a href="#">29+</a>
Microsoft IE (Desktop)	<a href="#">11+</a>	mp4	<a href="#">11+</a> (Windows 8.1+)	PlayReady	-
Microsoft Edge (Desktop)	<a href="#">All versions</a>	mp4, m2ts	<a href="#">All versions</a>	PlayReady (mp4 only)	In Development
Safari (Mac)	<a href="#">OS X Yosemite</a>	mp4, m2ts	<a href="#">OS X Yosemite</a>	FairPlay (m2ts only)	-
Opera (Desktop)	<a href="#">30+</a>	WebM	<a href="#">32+</a>	Widevine	15+
Firefox (Android)	<a href="#">41+</a>	<a href="#">mp4, WebM</a>	-	-	<a href="#">28+</a>
Chrome (Android)	<a href="#">30+</a>	mp4, WebM	<a href="#">42+</a>	Widevine	<a href="#">29+</a>
Safari (iOS)	-	-	-	-	-
Microsoft Windows Mobile	<a href="#">10+</a>	mp4	<a href="#">10+</a>	PlayReady (mp4 only)	-
Opera (Mobile)	<a href="#">30+</a>	WebM	-	-	-

## Comparing HTML5 Video and Flash Video

### Key Feature Comparison

Feature	HTML5 Video	Flash Video
Customizable Player	Yes	Yes
Platform	Native support in browser	Plugin
DRM decryption	Yes	Yes
Adaptive Bitrate Streaming	Yes	Yes
Ad Insertion	Yes	Yes
Plugin load time	N/A (0 m/s)	500ms–2000ms
GPU accelerated decode	Yes	Yes
Full Screen Viewing	Yes	Yes
Ad Protocol Support	VPAID 2	VPAID 1 and 2

### Technology Comparison

Feature	HTML5 Technology	Flash Technology
Supported Codecs	H.264 (most browsers) VP8/VP9 (Firefox, Chrome, Edge, Opera, Android)	VP6, H.264
DRM Support	Widevine, Playready, Fairplay PrimeTime (depends upon browser)	PrimeTime (formerly Access)
Supported Containers	mp4, WebM, m2ts (depends on browser)	mp4, flv
Adaptive Bitrate Support	MPEG-DASH	HLS, HDS

# Planning your Transition

Migrating to HTML5 video has several considerations. It's important to plan early and give your organization time to make the transition smoothly.

## Web Page User Interface

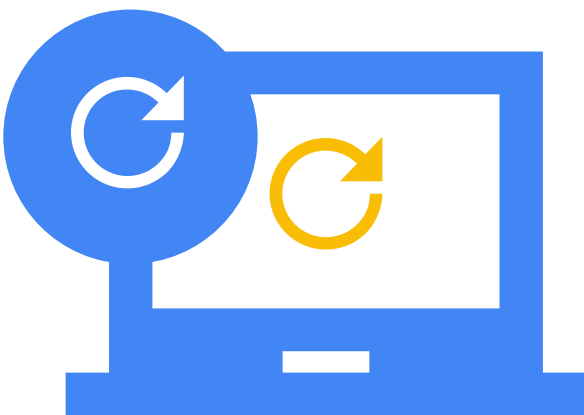
If you're using Flash for your video player, you may be using Flash for other user interface elements as well. Bookmarks, title metadata, chapter markers, even your company logo may be using Flash. Your creative team should already have HTML5 support for mobile platforms, but for the desktop they may use Flash in more ways than you expect.

Flash use is declining as users migrate to mobile web. Browsers are also changing the way that users interact with Flash – for example, requiring users to click on Flash applications before they play. It's important to audit the HTML5 experience early, and plan to make it the primary experience.



### **Takeaway:**

*Audit your use of Flash outside of the video player, and make a plan to transition to HTML5 as the preferred platform for your user interface.*



## Video Advertising

As you review video advertising, it is wise to talk with your ad clients and partners to plan the transition together. Advertisers will need to provide you with HTML5-friendly creatives that will work on your system, and you may wish to [convert existing Flash FLV creatives to MP4](#). The good news is that you can offer broader reach for those creatives across both desktop and mobile web, but early end-to-end testing is recommended to ensure a smooth transition.

It is also recommended that you talk with your web developers early about advertising. The IAB recommends the use of “Friendly iframes” to ensure compatibility with the rest of your site. Iframes are containers for HTML5 content within a page, and they give you control over what the content can and cannot do. For example, an iframe may control whether or not an ad can trigger pop-ups. This level of control is a critical conversation to have early with your web developers to ensure that your advertising requirements will be compatible with the other technology in your site, and with your overall security policies. You will also want to enable HTML5 VPAID 2 within your advertising platform.



### **Takeaway:**

*Talk with your ad clients and partners early, and plan end-to-end HTML5 creative testing. Talk with your web developers early to scope the impact of friendly iframes.*



## Key Decision: Adaptive Streaming?

Adaptive Streaming offers multiple quality levels and bit rates to the user by having the player choose which quality level and bit rate to play based upon the user's bandwidth and other factors. This generally results in a significantly better user experience with less buffering, leading to longer watch times.

If you choose to support adaptive streaming, your media will need to be processed for that purpose and your player will need to support it. The good news is that you may be processing your media anyway as you transition to HTML5 video, so this is the perfect time to improve the user experience.

## Video Player

Many video player libraries and partner companies support HTML5. Which approach you take may depend upon a variety of factors.

### Key Questions

1. Does your content require encryption and digital rights management?
2. Do you rely upon advertising? What type of ads do you need to support
3. Does your player have custom controls or displays such as title metadata?
4. Do you want to outsource development or do it yourself?
5. Do you use a single bit rate, or adaptive streaming?

Your approach to an HTML5 player will depend upon the answers to these questions. The level of customization that is required, and who you'd prefer to do the implementation, will affect your approach. For example, if you require significant customization and wish to write your own code, then player libraries such as Shaka Player allow you complete control over the user experience. In contrast, if you prefer an out-of-the-box solution, or would like a solution provider to do customization, there are several player companies that can help you.

Identifying your player requirements and approach early is important, because it may affect your transition schedule. For example, if you require significant customization, you will need to plan for the engineering work necessary to specify and implement the necessary changes.



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### **Takeaway:**

*Review your needs, and choose a player. Because you will be processing your media anyway, this may be an ideal time to migrate to an adaptive bit rate format.*

## Media Conversion

Your media may need conversion in order to work with HTML5. Media file formats and even some codecs supported in Flash may not be supported in HTML5. For example, VP6 video will need to be replaced with H.264 and possibly VP9, and FLV files should be converted to fragmented MP4 containers.

### Video File Format and Compression: Key Questions

- Will you be using adaptive bitrate streaming?
- What clients (devices) do you want to support?
- Is your media already encoded in H.264 that can be reused (repackaged)?
- Do you want to use VP9 to improve the viewer experience?
- Will you support multiple audio language tracks? How will the user select each one?
- Does your media have timed text or captions?

Wherever possible, the creation of your HTML5 content streams should be done from the original high-resolution, high-bitrate media, rather than simply converting your Flash assets. This will give you the highest possible quality and will also allow you more opportunity to improve your user experience.

Planning should also be done with your content delivery network (CDN) or service provider. Many such vendors offer media conversion services and may also have specific format requirements. Media conversion services can save on the infrastructure costs and labor involved with converting media yourself.

If you are converting the assets yourself, and if you only have a few hundred assets, you may wish to convert them using desktop software. Alternatively, if your media is hosted in the cloud, you may wish to use cloud services. Such an approach is particularly appropriate for non-encrypted media.

If you are converting a large, locally-stored library, or if you are encrypting your media, you might consider an enterprise-class encoder running on one or more servers. Such encoders can connect with key management systems (for DRM encryption) and can create multiple bitrate source files simultaneously (for adaptive streaming). It is also recommended to use different keys for each individual audio and video stream.

Finally, make sure to think through the user experience, particularly with audio and captions. If you have multiple audio tracks (for example, for different languages) then you may want the user to choose a track from the player user interface. In this case, you will need to match your player technology with your encoded video — for example, using separate streams for video and audio to save storage. Similarly, if you have timed text or captioning, the conversion of that data must be planned and tested early to ensure a smooth transition. With media formats the details matter and conversion can take time, so it's best to test the details early, before the bulk of the conversions occur.



### **Takeaway:**

*Think through your media format(s) early, plan for early testing within the player, and allocate time and money for media processing.*

## Key Decision: VP9?

VP9 offers significant compression efficiency compared to H.264, and VP9 playback has [demonstrably better video quality and user experience](#). This translates to broader reach in markets with low bandwidth, and lower transmission costs (VP9 can cut bandwidth requirements by as much as 50%). However, there are two key considerations with VP9.

First, while over two billion endpoints support VP9 playback, some browsers (e.g. Safari) do not. This means that VP9 cannot be used as a single format choice, and you will also require another format such as H.264. As a result, your storage and asset management costs may increase as you manage both VP9 and H.264 assets. The good news with VP9 is that it can lower CDN costs (by cutting bandwidth as much as 50%) and will improve viewer experience with faster playback start times.

Second, while most HTML5 browsers support VP9, some encoding solutions do not. You should review your existing encoding solutions to ensure VP9 support. Again, the benefits may outweigh the costs, and this analysis should be done early to make an informed decision.

## Digital Rights Management

If you need to protect your media, then you will need to encrypt it and use a digital rights management (DRM) system to control access. With HTML5, each browser and device requires a different DRM system: FairPlay, Access, PlayReady or Widevine. While most systems (e.g. Widevine and PlayReady) can use the same encrypted media streams, you will still require different key exchange systems and the maintenance of those systems needed to cover your target clients.

If you've been using Flash, you may already be maintaining multiple systems – for example, Access (for Flash) and Fairplay (for Apple devices). The good news is that while HTML5 may require you to maintain more DRM systems, it may also reduce your digital rights management licensing costs; some supported systems, such as Widevine, do not charge licensing or other fees. However, your HTML5 transition plan should include integration with business systems and proper key exchange during the media conversion process. In particular, you will likely want to separate your key store and business logic from individual DRM systems and only use the DRM servers to verify client requests and issue the actual licenses.

It is also recommended to use HTTPS delivery for media, to ensure user privacy and further protect your media. Talk with your web development team early about adding HTTPS support.



### **Takeaway:**

*HTML5 digital rights management may require you to manage more systems, but it also may reduce your licensing costs. Plan early to ensure that media processing and business systems are integrated with your DRM systems, and to ensure that you support HTTPS delivery.*

## Conclusion

HTML5 offers new and exciting opportunities for web and mobile video. As users move to the mobile web, and as the use of Flash declines, publishers should migrate to HTML5 video.

### HTML5 Video Migration: Key Considerations

- [Video player selection and customization](#)
- [Web page translation from Flash to HTML5](#)
- [Ad platform conversion to HTML5](#)
- [Media transformation to HTML5-friendly formats](#)
- [Digital rights management systems and content encryption](#)

Migrating from Flash to HTML5 can take several months, and publishers are urged to start planning their transition today. The improvement in user experience, watch times, and potential for lower operating costs make HTML5 a winning approach to web and mobile video.



## Technical Resources

The following links offer you more detail about **key HTML5 technologies**:

[Shaka Player](#) is an open source player that demonstrates the use of [Encrypted Media Extensions](#), [Media Source Extensions](#), and [MPEG-DASH](#) parsing. Shaka also offers several example MPEG-DASH manifests for developers, and an online [example player](#) to play them back.

VP9 is an open-source, royalty-free video codec maintained by the [WebM project](#), whose site offers [encoding guides](#).

The [EDASH packager](#) allows developers to encrypt media into a fragmented ISO BMFF format with common encryption ([CENC](#)) support.