Adobe® Primetime

PSDK 1.3 for iOS Programmer's Guide

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Contents

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Overview and prerequisites

The Adobe Primetime Software Development Kit (PSDK) client for iOS is a toolkit that provides you with the means to add advanced video playback functionality to your applications. This PSDK also supports ad insertion, content protection, and analytics.

The PSDK for iOS is implemented entirely in Objective-C . It includes an API and sample code to help you create an advanced media player and integrate Primetime features into the player.

This guide assumes that you understand developing applications using Objective-C. It walks you through the steps required to create a video player in Objective-C on iOS devices using the Primetime Player SDK.

Overview of the Player SDK

The Primetime Player SDK for iOS includes a variety of features.

The following list describes some of the PSDK's functionality:

- VOD and live/linear streaming
- Support for full-event replay
- Seamless ad insertion and tracking through VAST/VMAP
- Access to digital rights management (DRM)-related services
- Playback of HLS streams unencrypted or with Protected HTTP Live Streaming (PHLS), AES128, or
- Client tracking and QoS measurement and reporting
- Notifications that enable the PSDK and your application to communicate asynchronously about the status of videos, advertisements, and other elements, and also that log activity
- Management of the playback window, including methods that play, stop, pause, seek, and retrieve the playhead position
- Integration with Adobe Analytics and heartbeat support
- Closed captioning (608, WebVTT) and alternate forms of audio for increased accessibility
- DVR capability
- Bit-rate controls and adaptive bit-rate logic
- Custom cue tags for ads
- Failover
- Debug logging
- Adjustable playback buffers
- Subscription to HLS and non-HLS tags
- Customizable content/ad insertion workflow including blackout signaling
- Customizable advertising playback policies

Considerations

Keep this information in mind while using the PSDK for iOS .

- Playback is supported only for HTTP Live Streaming (HLS) content.

- Main video content can be either multiplexed (video and audio streams are in the same rendition) or unmultiplexed (video and audio streams are in separate renditions).
- The PSDK API is implemented in .
- Video playback requires the native Apple AV Foundation framework. This affects how and when media resources, including closed captions and timelines, can be accessed:
  - Timeline adjustments cannot be revised after the initial setup.

    For example, an advertisement cannot be removed from the timeline after it has played, so if the user seeks back in the presentation, the same ad plays again even if the normal policy would have been to remove it.
  - Depending on encoder precision, the actual encoded media duration may differ from the durations recorded in the stream resource manifest.

    There is no reliable way to resynchronize between the ideal virtual timeline and actual playout timeline. Progress tracking of the stream playback for ad management and Video Analytics must use the actual playout time, so reporting and user interface behavior might not precisely track the media and advertisement content.

Requirements

The iOS player requires specific properties for media content, manifest content, and software versions.

System and software requirements

Confirm that your hardware, operating system, and application versions are sufficient for this version of the PSDK.

Operating system	iOS 5.1 or later

Content and manifest requirements

Check the restrictions and requirements for streams and playlist/manifests, including DRM encryption keys.

Content segment duration	The duration of any given segment must not exceed the target duration specified in the manifest file.
Content segment key frames	Each content segment must begin with a key frame.
Sequence numbers in live/linear video	Sequence numbers must match between all bit-rate renditions for main content at any given time.

#EXT-X-VERSION requirements

The version of #EXT-X-VERSION in the .m3u8 file affects what features are available to your application and what EXT tags are valid in your playlist/manifest.

About the #EXT-X-VERSION tag, which specifies the HLS protocol version:

- The version must match the features and attributes contained within the HLS playlist; otherwise, playback errors might occur. Refer to the most recent version of the *HTTP Live Streaming specification*.
- If the tag is not included in the master or media playlists or if no version is specified, then version 1 is used by default and any content that does not comply with version 1 will not play.
- We recommend the use of at least version 2 for playback in PSDK-based clients. Clients and servers must implement the versions as follows for various features:

Use at least this version	To use these features
EXT-X-VERSION:2	The IV attribute of the EXT-X-KEY tag
EXT-X-VERSION:3	• Floating-point EXTINF duration values The duration tags (#EXTINF:<duration>,<title>) in version 2 were rounded to integer values. Version 3 and above require durations to be exact in floating point. • PSDK features such as Ad Insertion and seamless ABR
EXT-X-VERSION:4	• The EXT-X-BYTERANGE tag • The EXT-X-I-FRAME-STREAM-INF tag • The EXT-X-I-FRAMES-ONLY tag • The EXT-X-MEDIA tag • The AUDIO and VIDEO attributes of the EXT-X-STREAM-INF tag • PSDK alternate audio

Best practices

These are recommended practices for the Adobe PSDK for iOS .

- Use HLS Version 3.0 or above for program content.
- Use Apple's mediastreamvalidator tool to validate VOD streams.

New features for 1.3

Summary of product enhancements for the 1.3 iOS PSDK.

- **Blackout signaling**

  The opportunity resolver workflow (`PTOpportunityResolver`) is a component of the PSDK used to detect custom tags in the stream and create placement opportunities. These placement opportunities are then sent to the content resolver (`PTContentResolver`) to customize the content/ad insertion workflow based on the placement opportunity properties and metadata.

  The PSDK includes a default opportunity resolver that understands default ad cues, and a default ad resolver that provides ads to be inserted based on the ad metadata provided in the player item. You can replace these default resolvers to customize the workflow of custom tag detection and ad/content insertion to implement different scenarios such as recognizing custom tags for ad insertion, implementing a custom ad provider, or providing blackouts. See *Customize opportunity and content resolvers*.

- **Consistent and customizable ad behaviors**

  You can now customize your viewers' advertising experience. Set custom ad policies for unique viewer situations (play, seek) and business rules. Note that, due to the nature of ad splicing on iOS PSDK, it is not possible to remove existing ad breaks and ads can be skipped only through a seek operation. See *Customize playback with ads*.

- **Enhanced video analytics with heartbeat support**

  Turn-key integration with the Adobe Analytics and Primetime player monitoring through the Video heartbeat library. Simply provide your SiteCatalyst tracking server, report suite ID, and configuration parameters to have a fully

functional video implementation. Analytics about video viewing sessions can be viewed in real-time inside Primetime player monitoring and is fully integrated into your Adobe Analytics report suite.

See *Use Video Analytics in a PSDK-based player*.

SDK changes for 1.3

Several API interfaces have changed for the 1.3 PSDK for iOS .

Element	Description
New classes: • *PTAdPolicySelector* • *PTAdPolicyInfo*	Supports customizable ad playback behavior.
New classes: • *PTVideoAnalyticsTracker* • *PTVideoAnalyticsTrackingMetadata*	Integrates Primetime Video Analytics with PSDK.
New classes: • *PTContentResolver* class • *PTContentResolver* protocol • *PTPlacementOpportunity* class • *PTDefaultMediaPlayerClientFactory* • *PTOpportunityResolver* class • *PTOpportunityResolver* protocol • *PTContentResolverDelegate* • *PTMediaPlayerClientFactory* • *PTOpportunityResolverDelegate*	Enhances custom tag subscription along with related opportunity detectors and content resolvers.
Removed classes: • PTAdAvailInfo • PTAdHLSAsset • PTAdHLSAssetLoaderDelegate • PTAdResolver • PTAdResolverDelegate	

Create a video player

The PSDK provides the tools that you need for creating your own advanced video player application, which you can integrate with other Primetime components.

Follow these instructions to create your own Primetime player:

Set up the PTMediaPlayer

The `PTMediaPlayer` interface encapsulates the functionality and behavior of a media player object.

Set up your `PTMediaPlayer` based on the example below.

```
// 1. Fetch the URL from UI, maybe in a text field.
NSURL  *url  =  [NSURL  URLWithString:textFieldURL.text];

// 2. Create PTMetadata.
// Assume that the createMetada method prepares metadata (Described in Including advertising).
PTMetadata *metadata = [self createMetadata];

// 3. Create PTMediaPlayerItem using the PTMetadata instance created above.
PTMediaPlayerItem *item =
  [[[PTMediaPlayerItem alloc] initWithUrl:url mediaId:yourMediaID metadata:metadata]
autorelease];

// 4. Add observers to notifications dispatched from the PSDK.
// Assume that the addObservers method does that (Described in Set up notifications).
[self addObservers]

// 5. Create PTMediaPlayer using the PTMediaPlayerItem created above.
PTMediaPlayer *player = [PTMediaPlayer playerWithMediaPlayerItem:item];

// 6. Set properties on the player. For example:
player.autoPlay = YES;
player.closedCaptionDisplayEnabled = YES;
player.videoGravity = PTMediaPlayerVideoGravityResizeAspect;
player.allowsAirPlayVideo = YES;

// 7. Set the player's view property.
CGRect playerRect = self.adPlayerView.frame;
playerRect.origin = CGPointMake(0, 0);
playerRect.size = CGSizeMake(self.adPlayerView.frame.size.width,
self.adPlayerView.frame.size.height);

[player.view  setFrame:playerRect];
[player.view setAutoresizingMask:( UIViewAutoresizingFlexibleWidth |
UIViewAutoresizingFlexibleHeight  )];

// 8. Add the player's view in the current view's subview.
[self.adPlayerView  setAutoresizesSubviews:YES];
[self.adPlayerView addSubview:(UIView *)player.view];

// 9. Call play on the player.
[player play];
```

Set up notifications

The player can listen for a range of events that indicate the state of the player.

Assuming that `PTMediaPlayer` is a property of the client player, `self.player` in the following example represents the `PTMediaPlayer` instance. The following example implements the `addObservers` method shown in the PTMediaPlayer setup instructions, and includes most of the notifications:

```
[[NSNotificationCenter defaultCenter] addObserver:self
selector:@selector(onMediaPlayerStatusChange:)
name:PTMediaPlayerStatusNotification object:self.player];
[[NSNotificationCenter defaultCenter] addObserver:self
selector:@selector(onMediaPlayerNotification:)
name:PTMediaPlayerNewNotificationEntryAddedNotification object:self.player];
[[NSNotificationCenter defaultCenter] addObserver:self
selector:@selector(onMediaPlayerTimeChange:)
name:PTMediaPlayerTimeChangeNotification object:self.player];
[[NSNotificationCenter defaultCenter] addObserver:self
selector:@selector(onMediaPlayerItemPlayStarted:)
name:PTMediaPlayerPlayStartedNotification object:self.player];
[[NSNotificationCenter defaultCenter] addObserver:self
selector:@selector(onMediaPlayerItemPlayCompleted:)
```

```
name:PTMediaPlayerPlayCompletedNotification object:self.player];
[[NSNotificationCenter defaultCenter] addObserver:self
selector:@selector(onMediaPlayerItemTimelineChanged:)
name:PTMediaPlayerTimelineChangedNotification object:self.player];
[[NSNotificationCenter defaultCenter] addObserver:self
selector:@selector(onMediaPlayerItemMediaSelectionOptionsAvailable:)
name:PTMediaPlayerMediaSelectionOptionsAvailableNotification object:self.player];
[[NSNotificationCenter defaultCenter] addObserver:self
selector:@selector(onMediaPlayerAdBreakStarted:)
name:PTMediaPlayerAdBreakStartedNotification object:self.player];
[[NSNotificationCenter defaultCenter] addObserver:self
selector:@selector(onMediaPlayerAdBreakCompleted:)
name:PTMediaPlayerAdBreakCompletedNotification object:self.player];
[[NSNotificationCenter defaultCenter] addObserver:self
selector:@selector(onMediaPlayerAdPlayStarted:)
name:PTMediaPlayerAdStartedNotification object:self.player];
[[NSNotificationCenter defaultCenter] addObserver:self
selector:@selector(onMediaPlayerAdPlayProgress:)
name:PTMediaPlayerAdProgressNotification object:self.player];
[[NSNotificationCenter defaultCenter] addObserver:self
selector:@selector(onMediaPlayerAdPlayCompleted:)
name:PTMediaPlayerAdCompletedNotification object:self.player];
```

List of iOS Notifications

`ThePTMediaPlayerNotifications` class lists the notifications that the PSDK dispatches to your player.

Notification	Meaning
PTMediaPlayerAdBreakCompletedNotification	An ad break ended.
PTMediaPlayerAdBreakStartedNotification	An ad break started.
PTMediaPlayerAdClickNotification	A user clicked a banner ad.
PTMediaPlayerAdCompletedNotification	An individual ad ended.
PTMediaPlayerAdProgressNotification	An ad progressed; dispatched constantly while an ad plays.
PTMediaPlayerAdStartedNotification	An individual ad started.
PTMediaPlayerItemChangedNotification	A different PTMediaPlayerItem of the PTMediaPlayer has been set.
PTMediaPlayerItemDRMMetadataChanged	DRM metadata changed.
PTMediaPlayerMediaSelectionOptionsAvailableNotification	There are new subtitles and alternate audio tracks (PTMediaSelectionOption).
PTMediaPlayerNewNotificationEntryAddedNotification	A new PTNotification has been added to the PTNotificationHistoryItem of the current PTMediaPlayerItem, that is, when a notification event is added to the notification history.
PTMediaPlayerPlayCompletedNotification	Media playback ended.
PTMediaPlayerPlayStartedNotification	Playback started.
PTMediaPlayerStatusNotification	The player status changed. Possible status values are: • PTMediaPlayerStatusCreated • PTMediaPlayerStatusInitializing • PTMediaPlayerStatusInitialized

	• PTMediaPlayerStatusReady • PTMediaPlayerStatusPlaying • PTMediaPlayerStatusPaused • PTMediaPlayerStatusStopped • PTMediaPlayerStatusCompleted • PTMediaPlayerStatusError
PTMediaPlayerTimeChangeNotification	The playback current time changed.
PTMediaPlayerTimelineChangedNotification	The current player timeline changed.
PTTimedMetadataChangedNotification	The PSDK encountered the first occurrence of a subscribed tag.

Sample Handlers For Notifications

The following code snippets illustrate some of the ways you can use notifications.

Fetch the PTAdBreak instance using PTMediaPlayerAdBreakKey:

```
- (void) onMediaPlayerAdBreakStarted:(NSNotification *) notification {
  // Fetch the PTAdBreak instance using PTMediaPlayerAdBreakKey
  PTAdBreak *adBreak = [notification.userInfo objectForKey:PTMediaPlayerAdBreakKey];
  ...
  ...
}
```

Set subtitlesOptions and audioOptions:

```
- (void) onMediaPlayerItemMediaSelectionOptionsAvailable:(NSNotification \*) notification {
  //SubtitlesOptions and audioOptions are set and accessible now.
  NSArray* subtitlesOptions = self.player.currentItem.subtitlesOptions;
  NSArray* audioOp tions = self.player.currentItem.audioOptions;
  ...
  ...
}
```

Fetch the PTAd instance using PTMediaPlayerAdKey:

```
- (void) onMediaPlayerAdPlayStarted:(NSNotification \*)  notification {
  // Fetch the PTAdinstance using PTMediaPlayerAdKey
  PTAd *ad = [notification.userInfo objectForKey:PTMediaPlayerAdKey];
  ...
  ...
}
```

Configure the Player User Interface

With the PSDK, you can control the basic playback experience for live and video on demand (VOD). The PSDK does not configure the player for you; instead, it provides methods and properties on the player instance that you can use to configure the player user interface.

The following sections illustrate a variety of ways that you can configure the user interface:

Implement a Play/Pause Button

You can set up buttons that call PSDK methods to pause and play the media.

Implement a Play/Pause button using the following sample code as a guide:

```
_playPauseButton =
[[UIButton alloc] initWithFrame:CGRectMake(BUTTON_POS_X, BUTTON_POS_Y, BUTTON_SIZE_W,
BUTTON_SIZE_H)];
[_playPauseButton setImage:[UIImage imageNamed:@"play.png"] forState:UIControlStateNormal];
[_playPauseButton setImage:[UIImage imageNamed:@"pause.png"] forState:UIControlStateSelected];
[_playPauseButton addTarget:self action:@selector(playTouch:)
forControlEvents:UIControlEventTouchUpInside];
[self addSubview:_playPauseButton];

...

- (void)playTouch:(id)sender {
    if (self.player.status == PTMediaPlayerStatusPlaying) {
        _playPauseButton.selected = YES;
        [self.player pause];
    }
    else {
        _playPauseButton.selected = NO; [self.player play];
    }
}
```

Display the Duration of the Video

You can display the duration of the current active content.

Implement a video-duration display using the following sample code as a guide.

The *PTMediaPlayer* property, *seekableRange*, contains the current seekable window range:

- For VOD, this range is the entire VOD content range, with ads included.
- For live/linear, this range represents the seekable window.

```
CMTimeRange seekableRange = self.player.seekableRange;
if (CMTIMERANGE_IS_VALID(seekableRange)) {
    double start = CMTimeGetSeconds(seekableRange.start);
    double duration = CMTimeGetSeconds(seekableRange.duration);
}
```

Display the Current Time and Remaining Time

You can display the current and remaining time of the content you are showing.

Implement a display that shows the current and remaining time of the active content, using the following sample code as a guide:

```
// 1. Register for the PTMediaPlayerTimeChangeNotification
[[NSNotificationCenter defaultCenter] addObserver:self
selector:@selector(onMediaPlayerTimeChange:)
  name:PTMediaPlayerTimeChangeNotification object:self.player];

...

// 2. Create labels for displaying current and remaining time
_timeCurrentLabel = [[UILabel alloc] initWithFrame:CGRectMake(50.0, 16.0, 50.0, 21.0)];
_timeCurrentLabel.text = @"00:00:00";
_timeCurrentLabel.font = [UIFont boldSystemFontOfSize:12.0];
_timeCurrentLabel.numberOfLines = 1;
_timeCurrentLabel.textAlignment = UITextAlignmentCenter;
```

```
_timeCurrentLabel.backgroundColor = [UIColor clearColor];
_timeCurrentLabel.textColor =
  [UIColor colorWithRed:209.0/255.0 green:209.0/255.0 blue:209.0/255.0 alpha:1.0];
[self addSubview:_timeCurrentLabel];

_timeRemainingLabel = [[UILabel alloc] initWithFrame:CGRectMake(485.0, 16.0, 50.0, 21.0)];
_timeRemainingLabel.text = @"00:00:00";
_timeRemainingLabel.font = [UIFont boldSystemFontOfSize:12.0];
_timeRemainingLabel.numberOfLines = 1;
_timeRemainingLabel.textAlignment = UITextAlignmentCenter;
_timeRemainingLabel.backgroundColor = [UIColor clearColor];
_timeRemainingLabel.textColor =
  [UIColor colorWithRed:209.0/255.0 green:209.0/255.0 blue:209.0/255.0 alpha:1.0];

...

// 3. This method is called whenever the player time changes
(PTMediaPlayerTimeChangeNotification) - (void) onMediaPlayerTimeChange:(NSNotification
*)notification {
    //The seekable range provides the playback range of a stream
    CMTimeRange seekableRange = self.player.seekableRange;

    //Verify if the seekableRange is a valid CMTimeRange
    if (CMTIMERANGE_IS_VALID(seekableRange)) {
        double  duration = CMTimeGetSeconds(seekableRange.duration);
        double currentTime = CMTimeGetSeconds(self.player.currentItem.currentTime);
        if (CMTIME_IS_INDEFINITE(self.player.currentItem.duration)) {
            //If the duration is indefinite then the content is live.
            [_timeCurrentLabel setText:[NSString stringWithFormat:@"--:--"]];
            [_timeRemainingLabel setText:[NSString stringWithFormat:@"Live"]];
        }
        else {
            [_timeCurrentLabel setText:[self timeFormatter:currentTime]];
            [_timeRemainingLabel setText:[self timeFormatter:(duration - currentTime)]];
        }
    }
}
```

Display a Seek Scrub Bar With the Current Playback Time Position

You can display the current and remaining time of the content you are showing.

Implement a scrub bar, using the following sample code as a guide:

```
// 1. Register for the PTMediaPlayerTimeChangeNotification
[[NSNotificationCenter defaultCenter] addObserver:self
selector:@selector(onMediaPlayerTimeChange:)
  name:PTMediaPlayerTimeChangeNotification object:self.player];

...

_positionSlider = [[UISlider alloc] initWithFrame:CGRectMake(105.0, 14.0, 370, 24)];
[_positionSlider addTarget:self action:@selector(sliderThumbReleased:)
  forControlEvents:UIControlEventTouchUpInside];

...

// 2. Cover the event where the user moves to a different location in the stream
- (void)sliderThumbReleased:(id)sender {
    double  sliderTime = [_positionSlider  value];
    CMTimeRange seekableRange = self.player.seekableRange;
    if (CMTIMERANGE_IS_VALID(seekableRange)) {
        double start = CMTimeGetSeconds(seekableRange.start);
        double duration = CMTimeGetSeconds(seekableRange.duration);

        CMTime newTime = CMTimeMakeWithSeconds((sliderTime * duration) + start, AD_TIMESCALE);

        [self.player seekToTime:newTime];
```

```
    }
}

...

// 3. This method is called whenever the player time changes
(PTMediaPlayerTimeChangeNotification)
- (void) onMediaPlayerTimeChange:(NSNotification *)notification {
    CMTimeRange seekableRange = self.player.seekableRange;

    if (CMTIMERANGE_IS_VALID(seekableRange)) {
        double start = CMTimeGetSeconds(seekableRange.start);
        double duration = CMTimeGetSeconds(seekableRange.duration);
        double currentTime = CMTimeGetSeconds(self.player.currentItem.currentTime);

        if (duration > 0) {
            //Set the position slider value on the current playback time
            [_positionSlider setValue:((currentTime - start) / duration)];
        }
    }
}
```

Control the quality with adaptive bit rates (ABR)

The PSDK can play video assets that have multiple bit rates to provide more than one quality level.

Based on the bandwidth conditions and the quality of playback (frame rate), the video engine automatically switches the quality level to provide the best playback experience. The PSDK performs transitions between the various quality levels seamlessly and automatically. PSDK exposes the list of renditions and enables you to control some aspects of the adaptive streaming experience.

You can specify multiple profiles that have different bit rates. You can change your ABR settings at any time and the player switches to use the profile that most closely matches the most recent settings.

To configure the adaptive bit-rate (ABR) engine, choose values for the ABR parameters.

1. Decide on the minimum and maximum bit rates.

   These define a range of bit rates from which the ABR engine can choose. The ABR engine uses profiles only from this range when downloading fragments and rendering images on screen.

2. Decide on the initial bit rate, in bits per second, to use when beginning playback.

   For preload of the first downloaded fragment, the PSDK selects the profile with the bit-rate value that is closest to (equal to or less than) this initial value. For the first fragment, the minimum/maximum range is ignored.

3. Assign the new ABR parameter values to the media player.

```
@property (assign, nonatomic) int initialBitRate
@property (assign, nonatomic) int maxBitRate
@property (assign, nonatomic) int minBitRate
- (id)initWithABRControlParameters:(int)initialBitRate minBitRate:(int)minBitRate
maxBitRate:(int)maxBitRate
```

Monitor quality of service statistics

Quality of service (QoS) offers a detailed view into how the video engine is performing, without a lot of integration work.

Some QoS information that you can use:

Read QOS playback and device statistics

You can read playback and device statistics from the QOSProvider as often as needed.

The `PTQOSProvider` class provides various statistics, including information related to buffering, bit rates, frame rates, time data, and various other topics.

You can also get information about the device, such as model, operating system, and manufacturer's device ID.

1. Instantiate a media player.
2. Create a `PTQOSProvider` object and attach it to the media player.
   ```
   qosProvider = [[PTQOSProvider alloc]initWithPlayer:self.player];
   ```
   The `PTQOSProvider` constructor takes a player context, because it will need it to retrieve device-specific information such as the operating system.
3. Optionally read playback statistics.

   One solution for reading playback statistics would be to have a timer, such as an `NSTimer`, that periodically fetches the new QoS values from the `PTQOSProvider`. For example:
   ```
   - (void)printPlaybackInfoLog {
       PTPlaybackInformation *playbackInfo = qosProvider.playbackInformation;
       if (playbackInfo) {
           // For example:
           NSString *infoLog = [NSString stringWithFormat:@"observedBitrate :
                                  %f\n",playbackInfo.observedBitrate];
           [consoleView logMessage:@"====%@\n\n",infoLog];
       }
   }
   ```
4. Optionally read device-specific information.
   ```
    PTDeviceInformation *devInfo = qosProvider.deviceInformation;
   if (devInfo) {
       [consoleView logMessage:@"=== qosDeviceInfo:==\n os =%@\n model =
          %@\n id =%@\n\n", devInfo.os, devInfo.model, devInfo.id];
   }
   [NSTimer scheduledTimerWithTimeInterval:2.0 target:self
      selector:@selector(printPlaybackInfoLog) userInfo:nil repeats:YES];
   ```

Work with MediaPlayer objects

The `PTMediaPlayer` object represents your media player and a `PTMediaPlayerItem` represents audio or video on your player.

About the MediaPlayerItem class

Successfully loading a media resource creates an instance of the `PTMediaPlayerItem` class.

The The `PTMediaPlayer` starts by resolving the media resource and continues by loading the associated manifest file and parsing it (this is the asynchronous part of the resource loading process). At the end of the resource resolving process, the `PTMediaPlayerItem` instance is produced, so the `PTMediaPlayerItem` instance is basically the resolved version of a media resource.

The PSDK provides access to the newly created `PTMediaPlayerItem` instance through `PTMediaPlayer.currentItem`. Wait for the resource to be successfully loaded before accessing the media player item.

Lifecycle and states of the MediaPlayer object

From the moment when the `PTMediaPlayer` instance is created to the moment it is terminated (reused or removed), the `PTMediaPlayer` object completes a series of transitions from one status to another.

The list of statuses is defined in `PTMediaPlayerStatus`. You can retrieve the current status of the `PTMediaPlayer` object with `PTMediaPlayer.status`.

Knowing the player's status is useful because some operations are permitted only while the player is in a particular status. For example, `play` cannot be called while in PTMediaPlayerStatusCreated. It must be called after reaching the PTMediaPlayerStatusReady status.

The PTMediaPlayerStatusError status also changes what can happen next.

Here is how the basic procedure for loading a media resource inside the `PTMediaPlayer` corresponds to state transitions:

1. The initial status is PTMediaPlayerStatusCreated.
2. Your application calls `PTMediaPlayer.replaceCurrentItemWithPlayerItem`, which moves the player to PTMediaPlayerStatusInitializing.
3. The PSDK loads the resource. If successful, the status becomes PTMediaPlayerStatusInitialized.
4. Your application calls `PTMediaPlayer.prepareToPlay`.
5. The PSDK prepares the media stream and starts the ad resolving and ad insertion (if enabled).
6. When this finishes (either ads are inserted into the timeline or the ad procedure has failed), the player status becomes PTMediaPlayerStatusReady.
7. As your application plays and pauses the media, the status moves among PTMediaPlayerStatusPlaying and PTMediaPlayerStatusPaused ***iOS n/a***.
8. When the player reaches the end of the stream, the status becomes PTMediaPlayerStatusCompleted.
9. When your application releases the media player, the status becomes PTMediaPlayerStatusStopped.
10. If an error occurs at any time during the process, the status becomes PTMediaPlayerStatusError.

You can use the status to provide feedback to the user on the process (for example, a spinner while waiting for the next status change) or to take the next steps in playing the media, such as waiting for the appropriate status before calling the next method.

Include advertising

The Primetime SDK for iOS allows you to request ads for your live/linear and VOD content through its Primetime Ad Decisioning interface.

Ad Decisioning works with the PSDK to identify ad opportunities, resolve ads, and insert resolved ads into your video streams.

The following sections describe how to incorporate ads in your video content.

Advertising requirements

Advertising and main video content must meet certain requirements when you incorporate ads into your video content.

- The HLS version of the advertising content must be no later than the HLS version of the main content.
- Ad playlists should have the same bit-rate renditions as that of the main content playlist.
- Target duration and any individual fragment duration of the ad must not exceed the target duration of the main content.
- Whether the main content is multiplexed or not, any ads must be multiplexed and must also contain an audio-only rendition.
- Advertising content must have an audio-only stream if the main content also contains an audio-only stream.
- Advertising content must not be encrypted if the main content has subtitles streams.
- Advertising content must be multiple bit rate (MBR) if the main content is MBR.
- If the main content has alternate audio tracks, each ad must have at least an audio-only stream, or the ad is skipped.

About ad insertion

The PSDK advertising workflow has three phases, and information about ad placement comes from two possible sources.

PSDK ad insertion includes ad resolving for VOD, live streaming, and linear streaming, along with ad tracking and ad playback. The PSDK makes the required requests to the ad server, receives information about ads for the specified content, and places the ads into the content.

The PSDK groups ads into *ad breaks*, each of which contains one or more ads that play in sequence. The PSDK inserts ads into the main content as members of an ad break.

The PSDK process for placing ads within ad breaks into your main content has three phases:

- Opportunity detection: The PSDK uses stream information to detect possible and desired locations for ads.
- Ad resolution: The PSDK communicates with an advertisement server to retrieve the ads to splice into the content.
- Ad placement: The PSDK loads the specified ads and places them in ad breaks on the content timeline at the specified locations and recomputes the virtual timeline if needed.

The PSDK can obtain the possible locations for ad placement in two ways:

- Use manifest metadata/cues

  This is common for live/linear streams. The PSDK is responsible for detecting such metadata/cues, extracting the necessary information from them, and communicating with an advertising server to obtain the corresponding ads.

  The PSDK usually splices in the resolved ads by replacing main content at the location indicated by the metadata/cues; otherwise, the client would drop further and further behind the actual live point.

- Use advertising server map

  This is common for video-on-demand (VOD) streams. Usually, metadata about these streams are registered into the advertising server before playback. The PSDK retrieves the ad timeline and corresponding ads from the server. The PSDK usually splices the resolved ads by insertion into the main content as indicated by the server map.

By default, the PSDK uses manifest cues for live/linear streams and advertising server maps for VOD streams. However, to support full-event replay for live events, your application must take extra steps.

VOD Ad Resolving and Insertion

The PSDK supports several use cases for VOD ad resolving and insertion.

In VOD, the PSDK supports the following use cases:

• Pre-roll ad insertion

  PSDK inserts ads at the beginning of the content.

• Mid-roll ad insertion

  PSDK inserts one or more ads in the middle of the content.

• Post-roll ad insertion

  PSDK appends one or more ads at the end of the content.

The PSDK resolves the ads, inserts them at locations defined by the ad server, and computes the virtual timeline prior to starting playback. Once playback starts, no further changes can occur in the content. For example:

• No additional ad insertion will occur
• No inserted ads will be removed

Live and Linear Ad Resolving and Insertion

The PSDK supports several use cases for live and linear ad resolving and insertion.

The PSDK supports the following live and linear use cases:

• Pre-roll ad insertion

  PSDK inserts one or more ads at the beginning of the content.

• Mid-roll ad insertion

  PSDK inserts one or more ads in the middle of the content.

The PSDK resolves the ads and inserts them when a cue point is encountered in the live or linear stream. By default, the PSDK supports the following cues as valid ad markers when resolving and placing ads:

• #EXT-X-CUEPOINT
• #EXT-X-AD
• #EXT-X-CUE
• #EXT-X-CUE-OUT

These markers require the metadata field's DURATION in seconds and the cue’s unique ID. For example:

```
#EXT-X-CUE DURATION=27 ID=identiferForThisCue ...
```

You can define additional cues as described in “Subscribing to custom HLS tags".

Client ad tracking

The PSDK automatically tracks ads for VOD and live/linear streaming.

The PSDK uses notifications to inform your application about an ad's progress, such as when an ad begins and when it ends.

Playback behavior with ads: Default and customized

The behavior of media playback is affected by seeking, pausing, and the inclusion of advertising. The PSDK provides ways for you to override the default behavior.

Note: *For VOD and live/linear streaming, timeline adjustments cannot be revised once made, which means that an advertisement cannot be removed from the timeline after it has played. Therefore, if the user seeks back in the presentation, the same ad plays again even if the normal policy would have been to remove it.*

Note: *The PSDK does not provide a way to disable seeking during ads. Adobe recommends that your application disable seeking during ads.*

The following table describes how the PSDK handles ads and ad breaks during playback.

Description	Default PSDK behavior policy	Customization available through `PTAdPolicySelector`
During normal play, an ad break is encountered.	• PSDK plays the ad break, whether or not it has already been watched.	Specify a different policy for the ad break using `selectPolicyForAdBreak`.
Your application seeks forward over ad break(s) into main content.	Plays the last unwatched ad break that was skipped over, then resumes playback at the desired seek position upon break(s) playback completion.	Choose which of the skipped breaks to play using `selectAdBreaksToPlay`.
Your application seeks backward over ad break(s) into main content.	No ad break plays and skips to the desired seek position.	Choose which of the skipped breaks to play using `selectAdBreaksToPlay`.
Your application seeks forward into an ad break.	Plays from the beginning of the ad in which the seek ended.	Specify a different ad policy for the ad break and for the specific ad where the seek ended using `selectPolicyForSeekIntoAd`.
Your application seeks backward into an ad break.	Plays from the beginning of the ad in which the seek ended.	Specify a different ad policy for the ad break and for the specific ad in which the seek ended using `selectPolicyForSeekIntoAd`.
Your application seeks forward or backward over watched ad break(s) into main content.	If the last ad break skipped has already been watched, skips to the user-selected seek position.	Select which of the skipped breaks to play using `selectAdBreaksToPlay`, and determine which have already been watched using the `isWatched` property.
Your application seeks forward or backward over one or more ad breaks and drops into a watched ad break.	Skips the ad break and seeks to the position immediately following the ad break.	Specify a different ad policy for the ad break (with the watched status set to true) and for the specific ad

		where the seek ended using `selectPolicyForSeekIntoAd`.

Note: *By default, the PSDK marks an ad break as watched immediately upon entering the first ad in the ad break.*

Customize playback with ads

When playback reaches or passes an ad break or ends within an ad break, the PSDK defines certain default behavior for the positioning of the current playhead. You can override the default behavior through the `PTAdPolicySelector` class.

The default behavior might vary depending on whether the user passed the ad break during normal playback or by seeking in a video.

Here are some ideas for possible ad-playback behavior customization.

- Save the position in a video where the user stopped watching and resume the user at the same position in a future session.
- If an ad break is presented to the user, display no more ads for some number of minutes even if the user seeks to a new position.
- If the content fails to play (live or VOD) after a few minutes, restart the stream or fail over to a different source for the same content.

  On the fail-over playback session, you might want to disable pre-roll and/or mid-roll ads to allow the user to skip ads and resume to the previous failed position. The PSDK provides methods to enable skipping pre-roll and mid-roll ads.

Advertising API elements for playback

The PSDK provides classes and methods with which you can customize the playback behavior of content that contains advertising.

The following API elements are useful for customizing playback:

API element	Provides
PTAdMetadata	`adBreakAsWatched` property. Specifies the policy for marking an ad break as having been watched.
PTAdBreak	Whether an ad has been watched.
PTMediaPlayer	Get the local time of the playback; seek to that time.
PTAdPolicySelector	Protocol that allows customization of the PSDK ad behavior.
PTDefaultAdPolicySelector	Class that implements the default PSDK behavior. Your application can override this class to customize one or more of the default behaviors without having to implement the full interface.

API element	Provides
PTMediaPlayer	• `localTime`. The local time of the playback excluding the placed ad breaks. • `seekToLocalTime`. Seeks to a local time in stream. • `convertToLocalTime`. Converts a virtual position on the timeline to the local position.

Use the default playback behavior

You can choose to use default ad behaviors.

Set up for customized playback

You can customize or override ad behaviors supported by PSDK in two ways. In either case, you must register the ad policy instance with the PSDK.

To customize ad behaviors, your application can either:

- Conform to the `PTAdPolicySelector` protocol and implement all the required policy selection methods.

  This is recommended if you need to override all the default ad behaviors.

- Override the `PTDefaultAdPolicySelector` class and provide implementations for only those behaviors that require customization.

  This is recommended if you need to override only some of the default behaviors.

In both cases, do the following.

1. Register the policy instance to be used by the PSDK through the client factory.

   Note: *Any custom ad policy that is registered at the beginning of playback is cleared when the PTMediaPlayer instance is deallocated. Your application must register a policy selector instance every time a new playback session is created.*

   For example:

```
// Create an instance of the custom policy selector
PTS5MinuteSkipBreakPolicySelector *adPolicySelector
     = [[[PTS5MinuteSkipBreakPolicySelector alloc] initWithMediaPlayer:self.player]
autorelease];

// register this instance
[[PTDefaultMediaPlayerClientFactory defaultFactory] registerAdPolicySelector:adPolicySelector];
```

2. Implement any customizations.

Skip ad breaks for a certain period of time

Default PSDK behavior is to force an ad break to play when the user seeks over an ad break. You could customize the behavior to skip an ad break if the time elapsed from a previous break completion is within a certain number of minutes.

The following example of a customized ad policy selector skips any ads within the next five minutes (wall clock time) after a user has watched an ad break.

1. Register the policy instance to be used by PSDK through the client factory.

```
// Create an instance of the custom policy selector
PTS5MinuteSkipBreakPolicySelector *adPolicySelector
     = [[[PTS5MinuteSkipBreakPolicySelector alloc] initWithMediaPlayer:self.player]
autorelease];

// register this instance
[[PTDefaultMediaPlayerClientFactory defaultFactory] registerAdPolicySelector:adPolicySelector];
```

2. Implement your customization.

PTS5MinuteSkipBreakPolicySelector.h

```
#import "PTMediaPlayerNotifications.h"
#import "PTMediaPlayer.h"
#import "PTDefaultAdPolicySelector.h"

//  extend the default policy
selector@interface PTS5MinuteSkipBreakPolicySelector : PTDefaultAdPolicySelector

- (id)initWithMediaPlayer:(PTMediaPlayer *)player;

@end
```

PTS5MinuteSkipBreakPolicySelector.m

```
#import "PTS5MinuteSkipBreakPolicySelector.h"

double MIN_BREAK_INTERVAL  = 60 * 5; // 5 minutes

@implementation PTS5MinuteSkipBreakPolicySelector
{
    PTMediaPlayer *_player;
    NSTimeInterval _lastAdBreakPlayedTime;
}

- (id)initWithMediaPlayer:(PTMediaPlayer *)player
{
    if (self = [super init])
    {
        _lastAdBreakPlayedTime = 0;
        _player = [player retain];
        [self addobservers];
    }

    return self;
}

- (NSArray *)selectAdBreaksToPlay:(PTAdPolicyInfo *)info
{
    NSLog(@"%@ - selectAdBreaksToPlay (%f): %f", self,
        CMTimeGetSeconds(info.currentTime), _lastAdBreakPlayedTime);

    BOOL shouldPlay = [self shouldPlayAdBreaks];
    if (shouldPlay)
    {
        return [super selectAdBreaksToPlay:info];
    }

    return nil;
}

- (PTAdBreakPolicyType)selectPolicyForAdBreak:(PTAdPolicyInfo *)info
{
    NSLog(@"%@ - selectPolicyForAdBreak (%f): %f  %f", self,
            CMTimeGetSeconds(info.currentTime), _lastAdBreakPlayedTime,
            [[NSDate date] timeIntervalSince1970]);

    BOOL shouldPlay = [self shouldPlayAdBreaks];
```

```
    if (shouldPlay)
    {
        return [super selectPolicyForAdBreak:info];
    }

    return PTAdBreakPolicyTypeSkip;
}

- (BOOL)shouldPlayAdBreaks
{
    NSTimeInterval currentTime = [[NSDate date] timeIntervalSince1970];
    if (_lastAdBreakPlayedTime <= 0)
    {
        return YES;
    }

    if (_lastAdBreakPlayedTime > 0 && (currentTime - _lastAdBreakPlayedTime) >
MIN_BREAK_INTERVAL)
    {
        return YES;
    }

    // don't play any ad break if 5 minutes hasn't elapsed
    return NO;
}

- (void) onMediaPlayerAdBreakStarted:(NSNotification *) notification
{
    NSLog(@"%@ - AdBreak Start", self);
}

- (void) onMediaPlayerAdBreakCompleted:(NSNotification *) notification
{
    _lastAdBreakPlayedTime = [[NSDate date] timeIntervalSince1970];
    NSLog(@"%@ - AdBreak Complete at: %f", self, _lastAdBreakPlayedTime);
}

- (void)addobservers
{
    [[NSNotificationCenter defaultCenter] addObserver:self
selector:@selector(onMediaPlayerAdBreakStarted:)
                name:PTMediaPlayerAdBreakStartedNotification object:_player];
    [[NSNotificationCenter defaultCenter] addObserver:self
selector:@selector(onMediaPlayerAdBreakCompleted:)
                name:PTMediaPlayerAdBreakCompletedNotification object:_player];
}

- (void)removeObservers
{
    [[NSNotificationCenter defaultCenter] removeObserver:self];
}

- (void)dealloc
{
    [self removeObservers];
    [_player release];
    [super dealloc];
}

@end
```

Save the video position and resume later

You can save the current playback position in a video and resume the user at the same position in a future session.

Dynamically inserted ads differ between user sessions, so saving the position *with* spliced ads will refer to a different position in a future session. The PSDK provides methods to retrieve the playback position, ignoring spliced ads. Your application can then seek to a specific position while ignoring spliced ads.

1. When the user quits a video, retrieve and save the position in the video (excluding duration of ads).

   Ad breaks can vary in each session due to ad patterns, frequency capping, and so on. Therefore, the current time of the video in one session could be different in a future session. When saving a position in the video, retrieve the local time (which excludes the duration of all ads up to that position). Use the `localTime` property to read this position, which you can save either on the device or in a database on the server.

   For example, if the user is at the 20th minute of the video and this includes five minutes of ads, `currentTime` will be 1200 seconds, while `localTime` at this position will be 900.

   Note: *Local time and current time are the same for live/linear streams. In this case, `convertToLocalTime` has no effect. For VOD, local time remains unchanged while ads play.*

```
- (void) onMediaPlayerTimeChange:(NSNotification *)notification
{
    CMTimeRange seekableRange = self.player.seekableRange;

    if (CMTIMERANGE_IS_VALID(seekableRange))
    {
        double seekableRangeStart = CMTimeGetSeconds(seekableRange.start);
        double seekableRangeDuration = CMTimeGetSeconds(seekableRange.duration);
        double currentTime = CMTimeGetSeconds(self.player.currentTime); // includes ads
        double localTime = CMTimeGetSeconds(self.player.localTime); // no ads
    }
}
```

2. Resume the user at the same position.

   To resume the user to the same position saved from a previous session, use `seekToLocalTime`. Call this method *only* with local time values. Incorrectly calling it with the current time results in incorrect behavior. (To seek to the current time, use `seekToTime`.) When your application receives the `PTMediaPlayerStatusReady` status change event, seek to the saved local time.

```
[self.player seekToLocalTime:CMTimeMake(900, 1) completionHandler:^(BOOL finished) {
                [self.player play];
            }];
```

3. Provide the ad breaks to present to the user through the ad policy selector interface.

   Implement a custom ad policy selector (by extending the default ad policy selector). Provide the ad breaks that must be presented to the user by implementing `selectAdBreaksToPlay`. This method includes a pre-roll ad break and the mid-roll ad breaks before the local time position. Your application can decide to play a pre-roll ad break and resume to the specified local time, play a mid-roll ad break and resume to the specified local time, or play no ad breaks.

Primetime ad server metadata

The PSDK supports resolving and inserting ads for VOD and live/linear streams.

The PSDK resolves and inserts ads for both VOD and live/linear video streams. For detailed information about the Primetime ad server platform, refer to the ad server documentation:

Metadata prerequisites for ad insertion

You need to provide some metadata when you include advertising in your content.

To include advertising in your video content, you need to provide the following information:

• A `mediaID` (identifies the specific content to play)
• Your `zoneID` (identifies your company or Web site)
• Your ad server domain (specifies the domain of your assigned ad server)
• Other targeting parameters

Set up Primetime ad server metadata

Your application must provide the PSDK with the required *`PTAuditudeMetadata`* information for connecting to the ad server.

To set up the ad server metadata:

1. Create an instance of `PTAuditudeMetadata` and set its properties:

```
PTAuditudeMetadata *adMetadata = [[PTAuditudeMetadata alloc] init];
adMetadata.zoneId = @"INSERT_HERE_ZONE_ID";
adMetadata.domain = @"INSERT_HERE_DOMAIN";
```

2. Set the `PTAuditudeMetadata` instance as metadata for the current `PTMediaPlayerItem` metadata using the key `PTAdResolvingMetadataKey`:

```
// Metadata is an instance of PTMetadata that is used to create the PTMediaPlayerItem
[metadata setMetadata:adMetadata forKey:PTAdResolvingMetadataKey];
[adMetadata release];
```

```
PTMetadata *metadata = [self createMetadata];
PTMediaPlayerItem *item =
  [[[PTMediaPlayerItem alloc] initWithUrl:url mediaId:yourMediaID metadata:metadata]
autorelease];

- (PTMetadata *) createMetadata {
    PTMetadata* metadata = [[[PTMetadata alloc] init] autorelease];

    PTAuditudeMetadata *adMetadata = [[[PTAuditudeMetadata alloc] init] autorelease];
    adMetadata.zoneId = yourZoneID;
    adMetadata.domain = yourAdServerDomain;

    [metadata setMetadata:adMetadata forKey:PTAdResolvingMetadataKey];

    return metadata;
}
```

Enable ads in full-event replay

Full-event replay (FER) is a VOD asset that acts, in terms of ad insertion, as a live/DVR asset, so your application must take steps to ensure that ads are placed correctly.

For live content, the PSDK uses the metadata/cues presented in the manifest to determine where to place ads. However, sometimes live/linear content looks like VOD content, for example, when live content completes, an EXT-X-ENDLIST tag is appended to the live manifest. For HLS, the presence of the EXT-X-ENDLIST tag means that the stream is a VOD stream, and there is no way for the PSDK to automatically differentiate it from a normal VOD stream so that it can insert ads correctly.

Therefore, your application must notify the PSDK of this situation by specifying the `AdSignalingMode`.

For a FER stream, you do not want the Ad Decisioning server to provide the list of ad breaks that need to be inserted on the timeline prior to beginning playback, as would be usual for VOD. Instead, by specifying a different signaling mode, the PSDK reads all the cue points from the FER manifest and goes to the ad server for each cue point to request an ad break (similar to live/DVR).

Besides each request associated with a cue point, the PSDK makes an additional ad request for pre-roll ads.

1. Obtain from an external source (vCMS, etc.) the signaling mode that should be used.
2. Create advertising-related metadata as usual.
3. Specify the `PTAdSignalingMode` using `AdvertisingMetadata.setSignalingMode` if the default behavior must be overridden.

   Valid values are PTAdSignalingModeDefault, PTAdSignalingModeManifestCues, PTAdSignalingModeServerMap.

   You must set the ad signaling mode before calling `prepareToPlay`. After the PSDK has started resolving and placing ads on the timeline, any change to the ad signaling mode is ignored. The recommended way is to set it when creating the advertising metadata for the resource (when creating the advertising metadata for the resource).
4. Continue to playback as usual.

```
PTMetadata *metadata = [[[PTMetadata alloc] init] autorelease];
PTAuditudeMetadata *adMetadata = [[[PTAuditudeMetadata alloc] init] autorelease];
adMetadata.zoneId = your-auditude-zone-id;
adMetadata.domain = @"your-auditude-domain";
//adMetadata.enableDVRAds = YES; // FOR LIVE DVR case
//adMetadata.signalingMode = PTAdSignalingModeManifestCues;
// FOR VOD FER case
NSMutableDictionary *targetingParameters = [[[NSMutableDictionary alloc] init] autorelease];
[targetingParameters setValue:@"ipad" forKey:@"device"];
[targetingParameters setValue:@"preroll" forKey:@"AD_OPPORTUNITY_ID"];
adMetadata.targetingParameters = targetingParameters;
NSMutableDictionary *customParameters = [[[NSMutableDictionary alloc] init] autorelease];
[customParameters setValue:@"your-media-id" forKey:@"NW_ID"];
[customParameters setValue:@"preroll" forKey:@"AD_OPPORTUNITY_ID"];
adMetadata.customParameters = customParameters;
[metadata setMetadata:adMetadata forKey:PTAdResolvingMetadataKey];
```

Ad signaling mode

The ad signaling mode specifies from where the video stream should get advertising information.

Valid values are PTAdSignalingModeDefault, PTAdSignalingModeManifestCues, and PTAdSignalingModeServerMap.

The following table describes the effect of AdSignalingMode values for various HLS stream types.

	Default	**Manifest cues**	**Ad server map**
Video on Demand	• Uses server map for placement detection • Ads are inserted	• Uses in-stream cues for placement detection • Pre-roll ads are inserted in the main stream • Mid-rolls ads replace main stream	• Uses server map for placement detection • Ads are inserted
Live/linear	• Uses manifest cues for placement detection • Ads replace main stream	• Uses in-stream cues for placement detection • Ads replace main stream	Not supported

Companion banner ads

The PSDK supports companion banner ads, which are ads that display along with a linear ad and often remain on the page after the linear ad ends. Your application is responsible for displaying the companion banners that are provided with a linear ad.

Best practices for companion banner ads

When displaying companion ads, you should follow these recommendations.

- Your video player should attempt to present as many of a video ad's companion banner ads as will fit in your layout.
- Companion banners must not overlay the main ad/video container.
- Present a companion banner only if you have a location that exactly matches its specified height and width; never resize.
- Begin presenting the companion banner(s) as soon as possible after the ad begins.
- You do not need to remove companion banners after the ad ends; it is standard practice to display each companion banner until you have a replacement for it.

Companion banner data

The content of a `PTAdAsset` describes a companion banner.

The `PTMediaPlayerAdStartedNotification` notification returns an `PTAd` instance that contains a `companionAssets` property (array of PtAdAsset). The instance includes several properties; here are some that are useful for displaying banner ads.

Property	Description
width	Width of the companion banner in pixels.
height	Height of the companion banner in pixels.
resourceType	The resource type for this companion banner: • html : The data is in HTML code • iframe : The data is an iframe URL (src) • static: The data is a staticURL that is a direct URL to an image.
data	The data (of the type specified by resourceType) for this companion banner.

Display banner ads

Displaying banner ads involves creating banner instances and listening for ad-related events.

The PSDK provides a list of companion banner ads associated with a linear ad through the `PTMediaPlayerAdPlayStartedNotification` notification.

Manifests can specify companion banner ads as three possible types:

- By an HTML snippet
- By a URL to an iFrame page
- By a URL to a static image or an Adobe Flash SWF file

For each companion ad, the PSDK indicates which type or types are available for your application to use.

1. Create a `PTAdBannerView` instance for each companion ad slot on your page.

The banner instance should specify width and height to prevent retrieval of companions of different sizes. Specify standard banner sizes.

2. Add an observer for the `PTMediaPlayerAdStartedNotification` that does the following:
    1. Clear any previously existing ads in the banner instance.
    2. Get the list of companion ads from `PTAd.companionAssets`.
    3. If the list of companion ads is not empty, iterate over the list for banner instances.

        Each banner instance (a `PTAdAsset`) contains information necessary for displaying the companion banner, such as width, height, resource type (html, iframe, or static), and data.
    4. If a video ad has no companion ads booked with it, then the list of companion assets will contain no data for that video ad. In this case, if you want to show a standalone display ad, add the logic to your script to run a normal DFP display ad tag in the appropriate banner instance.
    5. Send the banner information to a function on your page that displays the banners in an appropriate location.

        This is usually a div, and your function uses the div ID to display the banner.

For example:

```
- (void) onMediaPlayerAdPlayStarted:(NSNotification *) notification {
    _currentAd  = [notification.userInfo  objectForKey:PTMediaPlayerAdKey];
    if (_currentAd != nil) {
        [self removeAllBanners]; // remove any existing PTAdBannerView views

        // banners
        if (_currentAd.companionAssets && _currentAd.companionAssets.count > 0) {
            PTAdAsset *bannerAsset = [_currentAd.companionAssets objectAtIndex:0];

            PTAdBannerView *bannerView = [[PTAdBannerView alloc] initWithAsset:bannerAsset];
            bannerView.player = self.player;
            bannerView.delegate = self;

            bannerView.frame = CGRectMake(0.0, 0.0, bannerAsset.width, bannerAsset.height);
            [_adBannerView.bannerView addSubview:bannerView];
        }
    }
}
```

Clickable ads

The PSDK provides you with information so that you can act upon click-through ads. As you create your player UI, you are responsible for deciding how to respond when a user clicks on a clickable ad.

For the iOS PSDK, only linear ads can be clickable.

Respond to clicks on ads

When a user clicks on an ad, companion banner ad, or a related button, your application is responsible for responding. The PSDK provides you with information about the destination URL for the click.

1. Set up an event listener for the PSDK to provide you with click-through information.
    a) Add an observer for `PTMediaPlayerAdClickNotification`.

    When an end user clicks a banner, the PSDK dispatches this notification, including information about the destination for the click.
2. Monitor user interactions on clickable ads.
3. When the user touches or clicks the ad or button, notify the PSDK.
    a) To do this, use `[_player notifyClick:_currentAd.primaryAsset];` .

4. Listen for the `PTMediaPlayerAdClickNotification` event from the PSDK.
5. Retrieve the click-through URL and related information.
   a) Use the `PTMediaPlayerAdClickURLKey` object.
6. Pause the video.
7. Use the click-through information to display the ad click-through URL and any related information.
   For example, you could display it in one of the following ways:
   • Open the click-through URL in a browser within your application.

     On desktop platforms, the video ad playback area is typically used for invoking click-through URLs upon user clicks.

   • Redirect the user to their external mobile web browser.

     On mobile devices, the video ad playback area is used for other functions, such as hiding and showing controls, pausing playback, expanding to full screen, and so on. Therefore, on mobile devices, a separate view, such as a sponsor button, is usually presented to the user as a means to launch the click-through URL.
8. Close the browser window in which the click-through information is displayed and resume playing the video.

For example:

```
// Listening for click notification
[[NSNotificationCenter defaultCenter] addObserver:self selector:@selector(onMediaPlayerAdClick:)

 name:PTMediaPlayerAdClickNotification object:self.player];
- (void) onMediaPlayerAdClick:(NSNotification *) notification {
   NSString *url = [notification.userInfo objectForKey:PTMediaPlayerAdClickURLKey];
   if (url != nil) {
       [self openBrowser:[NSURL URLWithString:url]];
   }
}
```

Repackage third-party ads

Some third-party ads cannot be stitched into the HLS content stream due to incompatible video formats. To address this situation, Primetime Ad Insertion and the iOS PSDK provide third-party creative repackaging for progressive-download MP4 videos.

In some situations, you might need to incorporate ads (creatives) that are transcoded and served by a third party into your ad insertion workflow. For example, these could be ads that are served by an agency ad server, by your inventory partner, or by an ad network.

If a requested ad is available only as an MP4, the PSDK skips that ad and issues a request to the Primetime Ad Insertion back end to repackage the ad as HLS so that a compatible version will be available the next time that the ad is encountered. The back end generates multiple-bit-rate HLS renditions of the ad and stores these on the Primetime CDN. Then, the next time the PSDK receives an ad response that points to that ad, the PSDK uses the HLS version from the Primetime CDN.

To enable this optional feature, contact your Adobe representative.

Ad Loading For a DVR Window

You can decide whether to resolve only the ads that occur after the user's current live point, or to also resolve ads that occur before the current live point.

When a user begins viewing at the beginning of a DVR stream, the PSDK resolves all ads for the stream at that time. If the user begins viewing at some point past the beginning of the stream, you can decide whether to resolve only the ads that occur after the user's current live point, or to also resolve ads that occur before the current live point. The first option is faster but prevents you from being able to play earlier ads if the user seeks backwards.

Control Ad Loading For a DVR Window

To control ad loading for a DVR window:

Set the `PTAdMetadata.enableDVRAds` property to YES to load all ads for the entire stream:
NO is the default, which loads ads only from the current live point forward.

For example:

```
PTMetadata *metadata = [[[PTMetadata alloc] init] autorelease];

PTAuditudeMetadata *adMetadata = [[[PTAuditudeMetadata alloc] init] autorelease];
adMetadata.zoneId = <ZoneId>;
adMetadata.domain = <Domain>;

// Enable DVR Ads by setting to YES the enableDVRAds property on PTAdMetadata
// (PTAuditudeMetadata is a subclass of PTAdMetadata)
adMetadata.enableDVRAds = YES;

[metadata setMetadata:adMetadata forKey:PTAdResolvingMetadataKey];

//Create PTMediaPlayerItem with the previously prepared metadata
playerItem = [[PTMediaPlayerItem alloc] initWithUrl:url mediaId:yourMediaID metadata:metadata];
```

Configure and use custom HLS tags

Media streams can carry additional metadata in the form of tags contained within the playlist/manifest file, such as to indicate the placement of advertising. You can specify custom tag names and be notified when certain tags appear in the manifest file.

The PSDK provides out-of-the-box support for specific #EXT advertising tags. Your application could use custom tags for enhancing the advertising workflow or for supporting blackout scenarios. To support such advanced workflows, the PSDK allows you to specify additional tags in the manifest beyond the standard tags, and to receive notification when these tags appear in the manifest file by subscribing to the tags. You can subscribe to custom tags both for VoD and live/linear streams.

Overview of custom tags

Here is an example of a customized VOD asset:

```
#EXTM3U
#EXT-X-VERSION:3
#EXT-X-TARGETDURATION:7

#EXT-X-ASSET:AID=10

#EXTINF:9.9766,
seg1.ts

#EXTINF:9.9766,
seg2.ts

#EXTINF:9.9766,
seg3.ts
```

```
#EXT-X-AD:DURATION=10
#EXTINF:9.9766,
seg4.ts

#EXTINF:9.9766,
seg5.ts

#EXT-X-ENDLIST
```

Your application could set up the following:

- To be notified when #EXT-X-ASSET tags, or any other set of custom tag names to which you have subscribed, are present in the file.
- To have ad insertion occur when an #EXT-X-AD tag, or any other custom tag name, is found in the stream.

Config class methods for tags

You can configure custom tag names in the PSDK globally with the `PTSDKConfig` class.

The PSDK applies the global configuration automatically to any media stream that does not specify a stream-specific configuration.

`PTSDKConfig` exposes these methods for managing the custom tags:

Subscribe to specific custom tags	
`subscribedTags`	Retrieves the current list of subscribed tags.
`setSubscribedTags`	Sets the list of subscribed tags that will be exposed to the application.
Customize the ad tags used by the default opportunity detector	
`adTags`	Retrieves the current list of ad tags.
`setAdTags`	Sets the list of ad tags that will be used by default opportunity generator.

Note the following:

- The setter methods do not allow the tags parameter to contain null values.
- The custom tag name must contain the # prefix. For example, #EXT-X-ASSET is a correct custom tag name; EXT-X-ASSET is incorrect.
- You cannot change the configuration after the media stream has been loaded.

Timed metadata class

When the PSDK detects a subscribed tag within the playlist/manifest, it automatically tries to process it and expose it in the form of a `PTTimedMetadata` object. The class provides the following elements.

Property	Type	Description
metadataId	NSString	Unique identifier of the timed metadata. Usually is extracted from the cue/tag ID attribute if present. Otherwise, a unique random value is provided.
name	NSString	The name of the timed metadata. If the type is TAG, then the value represents the cue/tag name. If the type is ID3, then this is null.

Property	Type	Description
time	CMTime	The time position, in milliseconds, relative to the start of the main content where this timed metadata is present in the stream.
type	PTTimedMetadataType	The type of the timed metadata. • TAG - indicates that the timed metadata was created from a tag contained within the playlist/manifest • ID3 - indicates that the timed metadata was created from an ID3 tag contained within the media stream

Note the following:

- The PSDK automatically extracts the attributes list into key-value pairs and stores them in the metadata property.
- If the extraction fails (due to a custom tag format), the content property sill always contains the tag's raw data (the string after the colon). No error is thrown in this case.

Element	Description
TAG, ID3	Possible types for the timed metadata.
`@property (nonatomic, assign) CMTime time`	The time position, relative to the start of the main content, where this metadata was inserted into the stream.
`@property (nonatomic, assign) PTTimedMetadataType type`	Returns the type of the timed metadata.
`@property (nonatomic, retain) NSString *metadataId`	Returns the ID extracted from the cue/tag attributes if present. Otherwise, a unique random value is provided.
`@property (nonatomic, retain) NSString *name`	Returns the name of the cue (usually the HLS tag name).

Subscribe to custom ad tags

The PSDK prepares `PTTimedMetadata` objects for subscribed tags every time they are encountered in the content manifest. You must subscribe to the tags before the playback starts.

To subscribe with the PSDK to be notified about custom tags within HLS manifests:

Set the custom ad tag names globally by passing an array that contains the custom tags to `setSubscribedTags` in `PTSDKConfig`.

Include the # prefix when working with HLS streams.

For example:

```
NSArray *customHLSTags = [NSArray
arrayWithObjects:@"#EXT-OATCLS-SCTE35",@"#EXT_CUSTOM_TAG2",nil];
[PTSDKConfig  setSubscribedTags:customHLSTags];
```

Add listeners for timed-metadata notifications

To receive notifications about tags in the manifest, implement the appropriate notification listener(s).

You can monitor timed metadata by listening for the following events, which notify your application of related activity:

- PTTimedMetadataChangedNotification: Every time that a unique subscribed tag is identified during parsing of the content, the PSDK prepares a new `PTTimedMetadata` object and dispatches this notification. The object contains

information about the tag name (what you subscribed to), the local time in the playback where this tag will appear, and other data.

- PTMediaPlayerTimeChangeNotification: For live/linear streams where the manifest/playlist refreshes periodically, additional custom tags might appear in the updated playlist/manifest, so additional TimedMetadata objects might be added to the MediaPlayerItem.timedMetadata property. This event notifies your application when this happens.

1.
2. Retrieve the timed metadata in one of the following ways.

   - Set your application to add itself as a listener to the `PTTimedMetadataChangedNotification` notification and fetch the object using `PTTimedMetadataKey`.

     ```
     [[NSNotificationCenter defaultCenter] addObserver:self
     selector:@selector(onTimedMetadataChanged:)
       name:PTTimedMetadataChangedNotification object:self.player.currentItem];

     - (void) onTimedMetadataChanged:(NSNotification *) notification {
         NSDictionary *timedMetadataUserInfo = [[NSDictionary alloc]initWithDictionary:
     notification.userInfo];
         PTTimedMetadata *newTimedMetadata = [timedMetadataUserInfo objectForKey:
     PTTimedMetadataKey];
     }
     ```

   - Access the `timedMetadataCollection` property of `PTMediaPlayerItem`, which consists of all the `PTTimedMetadata` objects that have been notified so far.

Store timed-metadata objects as they are dispatched

Your application is responsible for using the appropriate `PTTimedMetadata` objects at the appropriate times.

During content parsing, which happens prior to playback, the PSDK identifies subscribed tags and notifies your application about them. Therefore, the time associated with each `PTTimedMetadata` is the absolute time on the playback timeline.

NOTE: The code below assumes that there is only a single PTTimedMetadata instance at a given time. If there are multiple instances, the application must save them appropriately into a dictionary (one method is to create an array at a given time and store all instances in that array).

Your application must:

1. Keep track of the current playback time.
2. Match the current playback time against the already-dispatched `PTTimedMetadata` objects.
3. Use the `PTTimedMetadata` where the start time equals the current playback time.
   The following example shows how to save `PTTimedMetadata` objects in a NSMutableDictionary (timedMetadataCollection) keyed by the start time of each timedMetadata.

   ```
   NSMutableDictionary *timedMetadataCollection;

   - (void)onMediaPlayerSubscribedTagIdentified:(NSNotification *)notification
   {
       if (!timedMetadataCollection)
       {
           timedMetadataCollection = [[NSMutableDictionary alloc] init];
       }
       NSDictionary *userInfo = [notification userInfo];
       PTTimedMetadata *timedMetadata = [(PTTimedMetadata *)[userInfo
   objectForKey:PTTimedMetadataKey] retain];
       if ([timedMetadata.name  isEqualToString: @"#EXT-OATCLS-SCTE35"])
       {
            NSLog(@"Adding timedMetadata %@ to timedMetadataCollection with time
   ```

```
                %f",timedMetadata.name,CMTimeGetSeconds(timedMetadata.time));

        NSNumber *timedMetadataStartTime = [NSNumber
numberWithInt:(int)CMTimeGetSeconds(timedMetadata.time)];
        [timedMetadataCollection setObject:timedMetadata forKey:timedMetadataStartTime];
    }
    [timedMetadata release];
}
```

Use timed metadata at the appropriate time

Use TimedMetadata when the current playback time matches the start time.

Use the saved dictionary from the previous topic to actually use these saved `PTTimedMetadata` objects during playback.

1. Extract and update the current playback time from this notification and find all the `PTTimedMetadata` objects whose start time values match the current playback time. You can use these objects to perform various actions. For example:

```
- (void) onMediaPlayerTimeChange:(NSNotification *)notification
{
    CMTimeRange seekableRange = self.player.seekableRange;
    if (CMTIMERANGE_IS_VALID(seekableRange))
    {
        int currentTime = (int) CMTimeGetSeconds(self.player.currentTime);
        NSArray *allKeys = timedMetadataCollection ? [timedMetadataCollection allKeys] :
[NSArray array];
       NSMutableArray *timedMetadatasToDelete = [[[NSMutableArray alloc] init] autorelease];

        int count = [allKeys count];

        for (int i=count - 1; i > -1; i--)
        {
           NSNumber *currTimedMetadataTime = allKeys[i];
           if ([currTimedMetadataTime integerValue] == currentTime)
           {
            /*
                Use the timed metadata here and remove it from the collection.
            */
             NSLog (@"IN PLAYBACK TIME %i TO EXECUTE TIMEDMETADATA %@ scheduled at time
%f",currentTime,currTimedMetadata.name,CMTimeGetSeconds(currTimedMetadata.time));

            PTTimedMetadata *currTimedMetadata = [timedMetadataCollection
objectForKey:currTimedMetadataTime];
            [timedMetadatasToDelete addObject:currTimedMetadataTime];
           }
        }

        for (int i=0; i<[timedMetadatasToDelete count]; i++)
        {
            NSNumber *timedMetadataToDelete = timedMetadatasToDelete[i];
            [timedMetadataCollection removeObjectForKey:timedMetadataToDelete];
        }
    }
}
```

2. Periodically flush stale `PTTimedMetadata` instances from the list to prevent memory from growing continuously.

Customize opportunity detectors and content resolvers

An opportunity detector is a component of the PSDK that detects custom tags in a stream and identifies placement opportunities. These placement opportunities are then sent to the content resolver, which customizes the content/ad insertion workflow based on the placement opportunity properties and metadata.

The PSDK includes a default opportunity detector:

• (PTOpportunityResolver), which understands default ad cues

The PSDK also includes a default content resolver that provides content to be inserted based on the metadata key in the player item:

• PTContentResolver

You can override the default opportunity detectors and content resolvers to customize the advertising workflow in ways such as the following:

• Add support for custom tag detection
• Recognize custom tags for ad insertion
• Create a customized ad provider
• Black out content

About opportunity detectors and content resolvers

The PSDK provides default opportunity detectors and content resolvers that place ads into the timeline based on nonstandard tags within the manifest. Your application might need to alter the timeline based on opportunities to do so that are identified within the manifest, such as indicators for a blackout period.

An *opportunity* represents a point of interest on the timeline and usually indicates an ad placement opportunity but an opportunity can also indicate a custom operation that might affect the timeline (such as a blackout period). An *opportunity detector* is responsible for identifying specific opportunities (tags) in the timeline and notifying the PSDK that it has done so. Opportunities are identified in a timeline within `PTTimedMetadata` by the inclusion of a nonstandard (non-HLS) tag.

When your application is notified of such an opportunity (tag), it could alter the timeline in any manner, such as by inserting a series of ads, by switching to an alternate stream (blackouts), or by otherwise editing the timeline content. By default, the PSDK calls the appropriate *content resolver* to implement any timeline changes or actions required. Your application can use the default PSDK advertisement content resolver or register its own content resolver for different purposes.

The PSDK comes with a default content resolver that is responsible for resolving the default advertisement markers—#EXT-X-CUE, #EXT-X-AD, EXT-X-CUE-OUT, and EXT-X-CUEPOINT—inside the PSDK. Whenever one of these tags is encountered, control is transferred to the default ad resolver, which resolves advertisements for the PSDK to insert into the timeline.

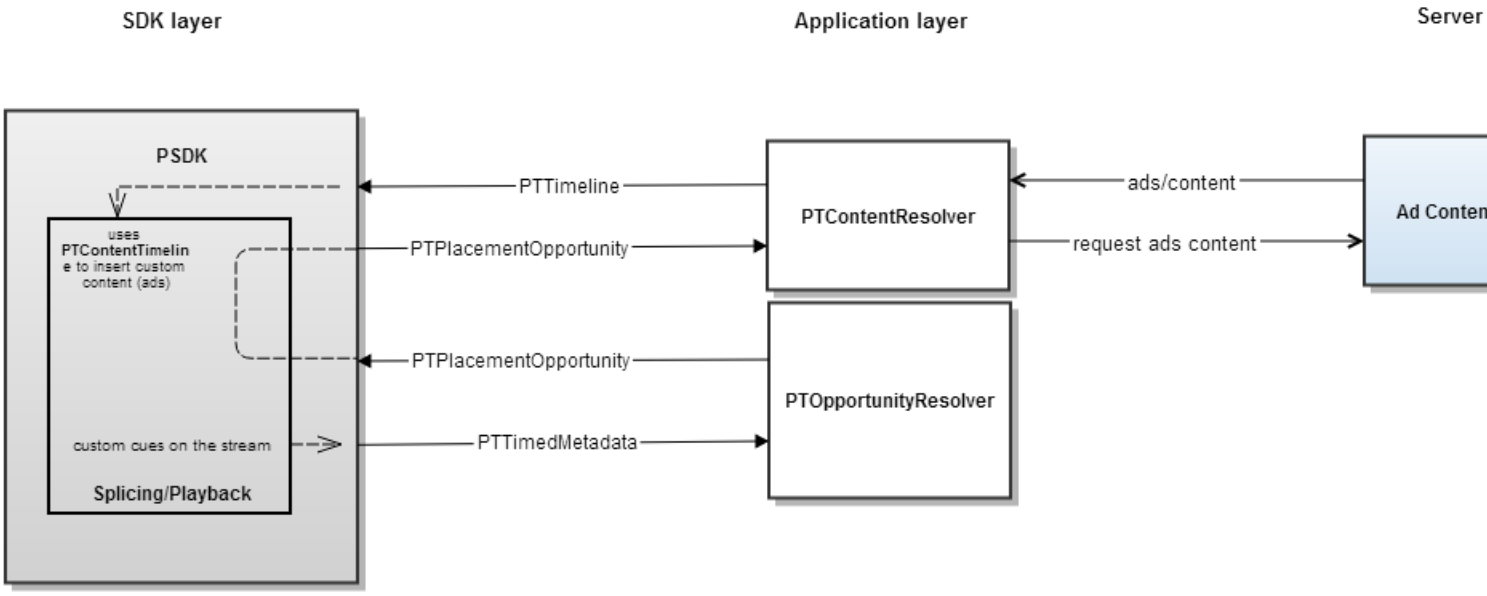
You can also use `PTSDKConfig.setAdTags.` to add more ad marker tags/cues for the PSDK to recognize and use `PTSDKConfig.setSubscribedTags` to have the PSDK notify your application about additional tags, which might carry information needed for the advertising workflow.

One possible use of a custom resolver is for blackout periods. To handle blackouts, your application could implement and register a blackout opportunity detector that is responsible for handling blackout tags. Whenever the PSDK encounters this specific tag, it polls all the registered content resolvers to find the first one that handles the specified

tag. In this case, it would be the blackout content resolver, which could, for example, replace the current item with alternate content on the player for the duration specified by the tag.

Implement a custom opportunity/content resolver

You can implement your own resolvers based on the default resolvers.



1. Develop a custom ad resolver by extending the `PTContentResolver` abstract class.

   `PTContentResolver` is an Interface that must be implemented by any content resolver class. An abstract class of the same name is also available that handles the configuration automatically (getting the delegate).

   Note: *`PTContentResolver` is exposed through the `PTDefaultMediaPlayerClientFactory` class. Clients can register a new content resolver extending the `PTContentResolver` abstract class. By default and unless specifically removed, a `PTDefaultAdContentResolver` is registered in the `PTDefaultMediaPlayerClientFactory`.*

```
@protocol PTContentResolver <NSObject>
@required
+ (BOOL)shouldHandleOpportunity:(PTPlacementOpportunity *)opportunity;
//Detector returns YES/NO if it should handle the following placement opportunity
- (void)configWithPlayerItem:(PTMediaPlayerItem *)item
              delegate:(id<PTContentResolverDelegate> delegate);
- (void)process:(PTPlacementOpportunity *)opportunity;
- (void)timeout:(PTPlacementOpportunity *)opportunity;
//The timeout method gets invoked if the PSDK decides that the
//PTContentResolver is taking too much time to respond.
@end

@interface PTContentResolver : NSObject <PTContentResolver>

@property (readonly) id<PTContentResolverDelegate> delegate;
@property (readonly) PTMediaPlayerItem *playerItem;

- (BOOL)shouldHandleOpportunity:(PTPlacementOpportunity *)opportunity;
- (void)configWithPlayerItem:(PTMediaPlayerItem *)item
               delegate:(id<PTContentResolverDelegate>) delegate;
- (void)process:(NSArray *)opportunities;
- (void)cancel:(NSArray *)opportunities;
@end
```

2. Implement `shouldResolveOpportunity` and return YES if it should handle the received `PTPlacementOpportunity`.
3. Implement `resolvePlacementOpportunity`, which starts loading the alternate content or ads.
4. When the ads are loaded, prepare a `PTTimeline` with the information about the content to insert. Some useful information about timelines:
    1. There can be multiple `PTAdBreak`s of types pre-roll, mid-roll, and post-roll. A `PTAdBreak` has:
        a. A `CMTimeRange` that has the start time and duration of the break. This is set as the range property of `PTAdBreak`.
        b. `NSArray` of `PTAd`s. This is set as the ads property of `PTAdBreak`.
    2. A `PTAd` represents the ad itself. Each `PTAd` has:
        a. A `PTAdHLSAsset` set as the primary asset property of the ad.
        b. Could also have multiple `PTAdAsset` instances as clickable ads or banner ads.

    For example:

```
NSMutableArray *ptBreaks = [[[NSMutableArray alloc] init] autorelease];

// Prepare the primary asset of the ad - links to ad m3u8
PTAdHLSAsset *ptAdAsset = [[[PTAdHLSAsset alloc] init] autorelease];
ptAdAsset.source = AD_SOURCE_M3U8;
ptAdAsset.id = FAKE_NUMBER_ID;
ptAdAsset.format = @"video";

// Prepare the ad itself.
PTAd *ptAd = [[[PTAd alloc] init] autorelease];
ptAd.primaryAsset = ptAdAsset;
ptAd.primaryAsset.ad = ptAd;

// Prepare the break and add the ad created above.
PTAdBreak *ptBreak = [[[PTAdBreak alloc] init] autorelease];
ptBreak.relativeRange = CMTimeRangeMake(BREAK_START_TIME, BREAK_DURATION_VALUE);
[ptBreak addAd:ptAd];

// Add the break to array of breaks.
[ptBreaks addObject:adBreak];

// Once all breaks have been prepared, they can be set on timeline
PTTimeline *_timeline = [[PTTimeline alloc] init];
_timeline.adBreaks = ptBreaks;
```

5. Call `didFinishResolvingPlacementOpportunity`, providing the `PTTimeline`.
6. Register your custom content/ad resolver to the default media player factory by calling `registerContentResolver`.

```
//Remove default content/ad resolver
[[PTDefaultMediaPlayerFactory defaultFactory] clearContentResolvers];

//Create an instance of your content/ad resolver (id <PTContentResolver>)
CustomContentResolver *contentResolver = [[CustomContentResolver alloc] init];

//Set custom content/ad resolver
[[PTDefaultMediaPlayerFactory defaultFactory] registerContentResolver:[contentResolver
autorelease]];
```

7. If you implemented a custom opportunity resolver, register it to the default media player factory.

Note: *Registering a custom opportunity resolver is not required to register a custom content/ad resolver.*

```
//Remove default opportunity resolver
[[PTDefaultMediaPlayerFactory defaultFactory] clearOpportunityResolvers];

//Create an instance of your opportunity resolver (id <PTOpportunityResolver>)
CustomOpportunityResolver *opportunityResolver = [[CustomOpportunityResolver alloc] init];
```

```
//Set custom opportunity resolver
[[PTDefaultMediaPlayerFactory defaultFactory]
          registerOpportunityResolver:[opportunityResolver autorelease]];
```

When the player loads the content and it is determined to be of type VOD or LIVE:

- If VOD, custom content resolver is used to get the ad timeline of the whole video.
- If LIVE, custom content resolver is called every time a placement opportunity (cue point) is detected in the content.

Subtitles and Closed Captioning

Subtitle streams run in parallel with the main content. Closed captions are part of the data packets of the MPEG-2 video streams inside of the video transmission stream.

Requirements For Subtitles

- Timestamp - The `X-TIMESTAMP-MAP` value, specified in the header section of the `WebVTT` file, should match the video timestamp.
- Supported on iOS 6.1 and later.

About Subtitles

Subtitle streams run in parallel with the main content. At any given time, the `PTMediaPlayer` plays main content and ads, where main content could be live/linear or VOD, and ads could be pre-roll, mid-roll, or post-roll.

Exposing Subtitles

The PSDK notifies the player client about the availability of internal AVAsset's `availableMediaCharacteristicsWithMediaSelectionOptions` through the `PTMediaPlayerMediaSelectionOptionsAvailableNotification` notification. The available subtitles can then be accessed through the `PTMediaPlayerItem` property, `subtitlesOptions`.

To expose subtitles:

1. The client registers itself as a listener for the `PTMediaPlayerMediaSelectionOptionsAvailableNotification` notification:

   ```
   [[NSNotificationCenter defaultCenter]
     addObserver:self selector:@selector(onMediaPlayerItemMediaSelectionOptionsAvailable:)
     name:PTMediaPlayerMediaSelectionOptionsAvailableNotification object:self.player];
   ```

2. When the client receives this notification, it implies that `PTMediaPlayerItem` has the available subtitles ready. The `onMediaPlayerItemMediaSelectionOptionsAvailable` method needs to be similar to this:

   ```
   - (void) onMediaPlayerItemMediaSelectionOptionsAvailable:(NSNotification *) notification {
       NSArray* subtitlesOptions = self.player.currentItem.subtitlesOptions;
       NSArray* audioOptions = self.player.currentItem.audioOptions;
   }
   ```

   See "Implementing Alternate Audio" for information about alternate audio tracks.

About Closed Captions

Closed captions are part of the data packets of the MPEG-2 video streams inside of the video transmission stream.

Closed captioning is supported to the extent provided by the AV Foundation framework.

Closed captioning allows people with hearing disabilities to have access to video programming by displaying the audio portion of the video as text on the screen. Closed captioning differs from subtitles in that subtitles are typically not in the same language as the audio and subtitles do not typically include information about background sounds such as the sound of a door slamming or music.

Exposing Closed Captions

To expose closed captions:

1. Turn on closed captioning in the iOS Accessability settings.
2. Set the `closedCaptionDisplayEnabled` property on the `PTMediaPlayer` object.

Set up alternate audio

Alternate (late-binding) audio is the support of multiple language tracks for HTTP video streams (live/linear and VOD) without having to duplicate and repackage the video for each audio track. Late binding of an audio track allows you to easily provide multiple language tracks for a video asset at any time before or after the asset's initial packaging.

Alternate audio tracks in the playlist

The playlist for a video can specify an unlimited number of alternative audio tracks for the main video content. With the PSDK, you can use these alternative tracks. For example, you might want to add different languages to your video content or allow the user to switch between different tracks on their device while the content is playing. This is known as late-binding audio.

Late-binding audio is the support of multiple language tracks for HTTP video streams (live/linear and VOD) without having to modify, duplicate, or repackage the video for each audio track. Late binding of an audio track allows you to easily provide multiple language tracks for a video asset at any time before or after the asset's initial packaging.

In order for the alternate audio to be mixed with the video track of the main media, the timestamps of the alternate track must match the timestamps of the audio in the main track.

The following requirements apply if you use alternate audio tracks and incorporate advertising:

• If the main content has alternate audio tracks, ads must at least have an audio-only stream.

• Each segment duration of an ad's audio-only stream must be equal to the segment duration of an ad's video stream.

The main audio track is included in the audio tracks collection with the label “default”. Metadata for the alternate audio streams is included in the playlist in the #EXT-X-MEDIA tags with TYPE=AUDIO.

For example, an M3U8 manifest that specifies multiple alternate audio streams might look like this:

```
#EXTM3U
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="bipbop_audio",LANGUAGE="eng",NAME="BipBop Audio 1",
 AUTOSELECT=YES,DEFAULT=YES
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="bipbop_audio",LANGUAGE="eng",NAME="BipBop Audio 2",
 AUTOSELECT=NO,DEFAULT=NO,URI="alternate_audio_aac/prog_index.m3u8"
#EXT-X-MEDIA:TYPE=SUBTITLES,GROUP-ID="subs",NAME="English",AUTOSELECT=YES,FORCED=NO,
```

```
 LANGUAGE="eng",URI="subtitles/eng/prog_index.m3u8"
#EXT-X-MEDIA:TYPE=SUBTITLES,GROUP-ID="subs",NAME="English (Forced)",DEFAULT=YES,
 AUTOSELECT=YES,FORCED=YES,LANGUAGE="eng",URI="subtitles/eng_forced/prog_index.m3u8"
#EXT-X-MEDIA:TYPE=SUBTITLES,GROUP-ID="subs",NAME="Français",AUTOSELECT=YES,FORCED=NO,
 LANGUAGE="fra",URI="subtitles/fra/prog_index.m3u8"
#EXT-X-STREAM-INF:PROGRAM-ID=1,BANDWIDTH=263851,CODECS="mp4a.40.2, avc1.4d400d",
 RESOLUTION=416x234,AUDIO="bipbop_audio",SUBTITLES="subs"
gear1/prog_index.m3u8
#EXT-X-STREAM-INF:PROGRAM-ID=1,BANDWIDTH=577610,CODECS="mp4a.40.2, avc1.4d401e",
 RESOLUTION=640x360,AUDIO="bipbop_audio",SUBTITLES="subs"
gear2/prog_index.m3u8
...
```

Access alternate audio tracks

The PSDK for iOS supports late-binding audio. The PSDK uses PTMediaPlayer to play a video specified in an M3U8 HLS playlist, which can contain several alternate audio streams.

Access the available audio tracks using methods and properties in the PTMediaPlayerItem class.

You can present the available tracks to the user through the player user interface. Refer to the PSDK demo application , which includes these operations in the scrub-bar controls.

Use Video Analytics in a PSDK-based Player

Video Analytics is Adobe's real-time video tracking solution, which is available to you through the Primetime SDK.

The Adobe Video Analytics feature encompasses two aspects of video tracking:

- **Primetime player monitoring** - This is provided with the PSDK. It provides real-time metrics about the quality of streaming, including the buffer rate, error rate, average bit rate, active streams, and startup time.
- **Adobe Analytics Video Essentials** - This is an add-on service. It provides video engagement metrics after the fact (nonrealtime), including video views, video completes, ad impressions, time spent on video, and more. For more information, contact your Adobe representative.

The following summarizes what you need to do to activate real-time video tracking in your PSDK-based player.

1. Initialize and configure the Video Analytics tracking components:
   - **AppMeasurement library** - Contains the low-level data collection core logic. This is where the video heartbeat data is accumulated and sent over the network.
   - **Video heartbeat library** - Contains the video-heartbeat data collection core logic. The video heartbeat library uses the AppMeasurement module in the sense that it needs access to a subset of its APIs, and delegates some work to it.

   Note: *You do not interact directly with the video heartbeat code, but instead use the PSDK API to configure and enable the video heartbeat real-time video tracking capabilities.*

   Important - The PSDK's built-in video tracking capability depends on a properly configured AppMeasurement instance. The PSDK tracking elements assume that the AppMeasurement library is already instantiated and configured before undertaking the configuration and activation of real-time video tracking. The PSDK delegates certain operations to the AppMeasurement library, thus the video tracking capabilities of the PSDK depend on the existence of a fully functional, properly configured instance of the AppMeasurement library.
2. Set up Video Analytics reporting on the server side, using Adobe Analytics Admin Tools and accessing Primetime player monitoring.

3. Access the Video Analytics reports on the real-time dashboard.

Initialize and configure Video Analytics

Configure Video Analytics real-time video tracking (video heartbeat) in a PSDK-based player.

The following items are required to activate real-time video tracking (video heartbeat) in a PSDK-based player for iOS :

- **Adobe PSDK for iOS**
- **Configuration / Initialization Information** - Your Adobe representative provides your specific video-tracking account information:

ADBMobileConfig.json	***Note:*** *IMPORTANT: The name and the path of this configuration file must not change. This JSON config file **must** be named `ADBMobileConfig.json`. The path to this file **must** be `<source root>/AdobeMobile .`*
AppMeasurement tracking server endpoint	The URL of the Adobe Analytics (formerly SiteCatalyst) back-end collection end-point.
Video Analytics tracking server endpoint	The URL of the Video Analytics back-end collection end-point. This is where all video heartbeat tracking calls are sent.
Account name	Also known as the Report Suite ID (RSID).
Job ID	The processing job identifier. This indicates to the back-end endpoint which kind of processing to apply for the video-tracking calls.
Publisher	The name of the content publisher (the brand or television channel using the video tracking capabilities).

To configure real-time video tracking in your PSDK-based player:

1. Configure load-time options in the `ADBMobileConfig.json` resource file:

```
{
    "version" : "1.1",
    "analytics" : {
        "rsids" : "YOUR_ADOBE_ANALYTICS_RSID",
        "server" : "URL_OF_THE_ADOBE_ANALYTICS_TRACKING_SERVER (provided by Adobe)",
        "charset" : "UTF-8",
        "ssl" : false,
        "offlineEnabled" : false,
        "lifecycleTimeout" : 5,
        "batchLimit" : 50,
        "privacyDefault" : "optedin",
        "poi" : []
    },
    "target" : {
        "clientCode" : "",
        "timeout" : 5
    },
    "audienceManager" : {
        "server" : ""
    }
}
```

Your load-time options are specified in this JSON-formatted configuration file. This file is bundled as a resource with the PSDK. The Primetime Player reads these values only at load time; they remain constant while your application runs. To configure load-time options:

a) Confirm that the JSON config file (`ADBMobileConfig.json`) contains the appropriate values (supplied by Adobe).
b) Confirm that this file is located in the `AdobeMobile` folder. This folder must be located in the root of your application source tree.
c) Compile and build your application.
d) Deploy and run the bundled application.

For more information on these AppMeasurement settings, see *Measuring Video in Adobe Analytics*.

2. Configure and activate Video Analytics and the PSDK's video heartbeat tracking.

   Video Analytics configuration follows the usual pattern of setting a specific metadata object on the `PTMediaPlayerItem` instance that is about to be sent to the player for playback. The VideoAnalytics metadata object has mandatory and optional configuration parameters.

   a) Set mandatory configuration parameters (provided by Adobe).

      Provide these as input arguments to the constructor for the `PTVideoAnalyticsTrackingMetadata` class:

      • URL of the Video Analytics tracking endpoint
      • Job ID
      • Publisher Name

   b) Set optional configuration parameters.

      These are publicly accessible instance variables on the `PTVideoAnalyticsTrackingMetadata` class.

      Important: *To send heartbeat calls over the network, you **must explicitly** enable the video heartbeat feature. If you do not, no video heartbeat calls will be sent; the legacy Milestone tracking provided by the AppMeasurement library will be used instead.*

      • `enableHeartbeat` - Explicitly activate heartbeat tracking (`trackingMetadata.enableHeartbeat = YES;`) to activate the video heartbeat calls used for real-time analytics and Video Essentials.
      • `debugLogging` - Set this flag to true to activate tracing messaging. Note that setting this flag to `true` may impact performance. This logging might be useful during development and debugging efforts, but you must set this flag to `false` for the production version of your player application. Logging is disabled (`false`) by default.
      • `trackLocal` - Set this flag to `true` to activate quiet mode. In this mode, no network calls are sent over the network. You can use this mode in conjunction with setting the `debugTracking` flag to `true`. In this case, you can see the HTTP calls in the trace console without actually sending anything over the network.
      • `debugTracking` - Set this flag to `true` to track URLs in HTTP calls.

   Sample Video Analytics configuration:

```
// Instantiate VideoAnalytics tracking metadata.
PTVideoAnalyticsTrackingMetadata *trackingMetadata =
    [[[PTVideoAnalyticsTrackingMetadata alloc]
       initWithTrackingServer:@"THE_URL_OF_THE_VIDEO_HEARTBEATS_SERVER (provided by Adobe)"
                        jobId:@"YOUR_JOB_ID"
                    publisher:@"YOUR_PUBLISHER_NAME"] autorelease];

trackingMetadata.playerName = @"YOUR_PLAYER_APP_NAME";

// Set this to true to activate the debug tracing.
trackingMetadata.debugLogging = YES;

// Set this to true to log the URLs of the output HTTP calls.
trackingMetadata.debugTracking = YES;
```

```
// This defaults to YES, which activates the "quiet" mode.
// Make sure "quiet mode" is NOT on, to actually send network calls.
trackingMetadata.trackLocal = NO;

// Explicitly activate the video heartbeat functionality.
trackingMetadata.enableHeartbeat = YES;

// Set the metadata on the ROOT metadata.
PTMetadata *root = [[[PTMetadata alloc] init] autorelease];
[root setMetadata: trackingMetadata forKey: PTVideoAnalyticsTrackingMetadataKey];

// Attach the ROOT metadata on the media item.
PTMediaPlayerItem *mediaItem = [[[PTMediaPlayerItem alloc]
          initWithUrl:nsurl mediaId:@"video-id" metadata:root] autorelease];
```

After you provide the metadata to the `PTMediaPlayerItem`, call the `initWithMediaPlayer` method right after the player has been created.

```
// Create a new Video Analytics Tracker instance using the current media player
// instance to start tracking video analytics data
self.videoAnalyticsTracker = [[[PTVideoAnalyticsTracker alloc]
initWithMediaPlayer:self.player] autorelease];
```

Set up Video Analytics reporting on the server side

Adobe Analytics Video Essentials requires setup on the server side.

If you are using only the built-in Primetime player monitoring feature of Video Analytics, you can skip this topic. Reporting setup is necessary only if you are using Adobe Analytics Video Essentials (which provides video engagement metrics). Your Adobe representative will handle most aspects of the server-side setup for Adobe Analytics reporting, but you can also see detailed documentation on the process here: *Analytics Help and Reference - Report Suite Manager*.

To complete your server-side setup using Analytics setup:

1. Enable conversion level for RSID:
   a) Access **Admin Tools.**
   b) Select **Report Suites.**
   c) Select the RSID to set up.
   d) Select **Edit Settings** > **General** > **General Account Settings.**
   e) Choose **Enabled, no Shopping Cart** in the **Conversion Level** combo box.
   f) Click **Save**.
2. Enable video tracking:
   a) Access **Admin Tools.**
   b) Select **Report Suites.**
   c) Select the RSID to set up.
   d) Select **Edit Settings** > **Video Management** > **Video Reporting.**
   e) Click **Yes, start tracking**.

Access Video Analytics reports

Access Video Analytics reports on Adobe Analytics and on Primetime player monitoring.

Video Analytics reports are routed to two different reporting platforms:

• Adobe Analytics

• Primetime player monitoring

1. Access Adobe Analytics:
   a) Select the video-tracking enabled RSID.
   b) Select Video > Video Engagement > Video Overview.

      This displays the overview report.

   c) Select a video clip.

      This displays the minute-level granularity drop-off report.

   For more information on Adobe Analytics setup, see *Adobe Analytics Documentation Home*.
2. Access Primetime player monitoring:
   a) Navigate to `http://rtd.adobeprimetime.com`.
   b) Log in with your credentials. (Your Adobe representative will create the account for you if you do not have one.)

      An overview report displays a list of all running videos.

   c) Select a video from the list.

      The real-time report for the selected video is displayed.

   To view examples of video reports, see *Video Reports.*

Content security using DRM

You can use the features of the Primetime digital rights management (DRM) system to provide secure access to your video content.

Primetime DRM provides a scalable, efficient workflow for digital rights management to help you deliver and protect your premium video content. You protect and manage the rights to your video content by creating licenses for each digital media file. The PSDK gives you the ability to implement and deploy content protection.

Refer to the Adobe Access Help Resource Center for complete DRM documentation.

DRM interface overview

The key element of the digital rights management (DRM) system is the DRM manager.

• A reference in the PTMediaPlayer to the DRM manager object that implements the DRM subsystem:

```
@property (readonly, nonatomic) DRMManager *drmManager
```

The PSDK issues a `PTMediaPlayerItemDRMMetadataChanged` notification when DRM metadata changes.

If the DRM-protected stream is multiple bit-rate (MBR) encoded, the DRM metadata used for the variant playlist should be the same as the one used in all the bit-rate streams.

Use the notification system

The notification portion of the PSDK library allows you to create a logging and debugging system that can be useful for diagnostic and validation purposes.

`PTNotification` notifications provide information about *player status* as information, warnings, or errors. Your application can retrieve data that describes what caused the error or warning. Errors that stop the playback of the video also cause a change of the status of the player.

Note:

The PSDK also uses notification to refer to `NSNotifications` (`PTMediaPlayer` notifications) event notifications, which the PSDK dispatches to provide information about player activity. You implement event listeners to capture and respond to those. Many event notifications also cause `PTNotification` status notificatons.

The PSDK issues `PTMediaPlayerNewNotificationItemEntryNotification` when a `PTNotification` is issued.

Notification content

`PTNotification` notifications provide information related to the player's status.

The PSDK provides a chronologically sorted list of `PTNotification` notifications. Each notification contains the following:

- Time stamp
- Diagnostic metadata, including a numeric code, a name for the notification, metadata keys, and related inner notifications

The diagnostic metadata consists of the following elements:

Element	Description
type	Describes the notification event type. Depending on the platform, this property is an enumerated type with possible values of INFO, WARN, and ERROR. This is the first, and highest-level, classification criterion for the notification events.
code	The numerical representation assigned to the notification event. • Error notification events, from 100000 to 199999 • Warning notification events, from 200000 to 299999 • Information notification events, from 300000 to 399999
name	A string containing a human-readable description of the notification event, such as PLAYBACK_START.
metadata	Metadata containing relevant information about the notification stored as key/value pairs. For example, a key named `URL` would provide a URL related to the notification, such as an invalid URL that caused an error.
innerNotification	A reference to another `PTNotification` object that directly impacted this notification. An example might be a notification about an ad-insertion failure that directly corresponds to a time-line insertion conflict.

You can store this information locally for later analysis or send it to a remote server for logging and graphical representation.

Notification setup

The PSDK sets up the player for basic notifications, while you must perform the same setup for your own custom notifications.

There are two implementations for `PTNotification`:

• One for listening
• One for adding custom notifications to `PTNotificationHistory`

For listening to notifications, the PSDK instantiates the `PTNotification` class and attaches it to an instance of the `PTMediaPlayerItem`, which is attached to a PTMediaPlayer instance. There is only one `PTNotificationHistory` instance per `PTMediaPlayer`.

If you are adding customizations, your application, rather than the PSDK, must perform those set-up steps.

Listening To Notifications

There are two ways of listening to the `PTNotification` notification of the `PTMediaPlayer`:

1. Manually check the `PTNotificationHistory` of the `PTMediaPlayerItem` with a timer and check the differences:

```
//Access to the PTMediaPlayerItem
PTMediaPlayerItem *item = self.player.currentItem;
PTNotificationHistory *notificationHistory = item.notificationHistory;

//Get the list of notification events from the notification History
NSArray *notifications = notificationHistory.notificationItems;
```

2. Use the posted *NSNotification* of the `PTMediaPlayerPTMediaPlayerNewNotificationEntryAddedNotification`. Register to the `NSNotification` using the instance of the `PTMediaPlayer` from which you want to get notifications:

```
//Register to the NSNotification

[[NSNotificationCenter defaultCenter] addObserver:self
selector:@selector(onMediaPlayerNotification:)
  name:PTMediaPlayerNewNotificationEntryAddedNotification object:self.player];
```

Implementing Notification Callbacks

Implement the notification callback by getting the `PTNotification` from the `NSNotification` user info, and reading its values by using the key `PTMediaPlayerNotificationKey`:

```
- (void) onMediaPlayerNotification:(NSNotification *) nsnotification {
    PTNotification *notification = [nsnotification.userInfo
objectForKey:PTMediaPlayerNotificationKey];
    NSLog(@"Notification: %@", notification);
}
```

Adding Custom Notifications

To add a custom notification:

Create a new `PTNotification` and add it to the `PTNotificationHistory` by using the current `PTMediaPlayerItem`:

```
//Access to the PTMediaPlayerItem
PTMediaPlayerItem *item = self.player.currentItem;
PTNotificationHistory *notificationHistory = item.notificationHistory;

//Create notification
PTNotification* notification = [[PTNotification notificationWithType:PTNotificationTypeWarning
 code:99999 description:@"Custom notification description"];
```

```
//Add notification
[notificationHistory addNotification:notification];
```

Customized Logging

You can implement your own logging system.

In addition to logging using predefined notifications (described in "*The Notification System*"), you can implement your own logging system that uses your own log messages and messages generated by the PSDK. You can use these logs to assist with troubleshooting your player applications and to provide better understanding of the playback and advertising workflow.

Customized logging uses a shared singleton instance of the `PSDKPTLogFactory`, which provides a mechanism for logging messages to multiple loggers. You define and add (register) one or more loggers to the `PTLogFactory`. This allows you to define multiple loggers with custom implementations, such as a console logger, web logger, or console history logger.

The PSDK generates log messages for many of its activities, which the `PTLogFactory` forwards to all registered loggers. In addition, your application can generate custom log messages, which are also forwarded to all registered loggers. Each logger can then filter the messages in any way that you choose and take appropriate action.

There are two implementations for `PTLogFactory`. One is for listening to logs and the second one is for adding logs to a `PTLogFactory`.

Listening to Logs

To register for listening to logs:

1. Implement a custom class that follows the protocol `PTLogger`:

```
@implementation PTConsoleLogger

+ (PTConsoleLogger *) consoleLogger {
    return [[[PTConsoleLogger alloc] init] autorelease];
}

- (void)logEntry:(PTLogEntry *)entry {
    //Log the message to the console using NSLog
    NSLog(@"[%@] %@", entry.tag, entry.message);
}

@end
```

2. Add an instance of the `PTLogger` to the `PTLoggerFactory` to register the instance to receive logging entries:

```
PTConsoleLogger *logger = [PTConsoleLogger consoleLogger];
// Either use the addLogger method:
[[PTLogFactory sharedInstance] addLogger:(logger)]

//Or replace the preceding line with this macro for ease of use
//PTLogAddLogger(logger);
```

Example of filtering logs by using the `PTLogEntry` type:

```
@implementation PTConsoleLogger

+ (PTConsoleLogger *) consoleLogger {
    return [[[PTConsoleLogger alloc] init] autorelease];
}
```

```
- (id) init {
    self = [super init];

    if (self) {
        self.logLevel = PTLogEntryTypeInfo;
    }

    return self;
}

- (void)logEntry:(PTLogEntry *) entry {
    //Filtering the entry by log level
    if (entry.type < _logLevel) {
        return;
    }

    //Log the message to the console using NSLog NSLog(@"[%@] %@", entry.tag, entry.message);
}

@end
```

Adding New Log Messages

To register for listening to logs:

Create a new `PTLogEntry` and add it to `thePTLogFactory`:

You can either manually instantiate a `PTLogEntry` and add it to the `PTLogFactory` shared instance or use one of the macros to accomplish the same task.

Example of logging using the PTLogDebug macro:

```
// The following line creates an instance of PTLogEntry with type PTLogEntryDebug,
// tag "DEBUG_PLAYBACK", and message "Playback has started".
// Then the PTLogEntry is automatically added to the PTLogFactory

PTLogDebug(@"[DEBUG_PLAYBACK] Playback has started");
```

Understanding Failover

Failover handling occurs whenever a variant playlist has multiple renditions for the same bit rate and one of the renditions stops working.

In this case, the player switches between renditions as described here.

The following example shows a variant playlist with failover URLs of the same bit rate:

```
#EXTM3U
#EXT-X-STREAM-INF:PROGRAM-ID=1, BANDWIDTH =700000
http://sj2slu225.corp.adobe.com:8090/_default_/_default_/livestream.m3u8

#EXT-X-STREAM-INF:PROGRAM-ID=1, BANDWIDTH =700000
http://sj2slu225.corp.adobe.com:8091/_default_/_default_/livestream.m3u8
```

When the PSDK loads the variant playlist, it creates a queue that holds the URLs for all the renditions of the content for the same bit rate. Whenever a request for a URL fails, the PSDK then uses the next URL of the same bit rate from the failover queue. At any specific failure time, the PSDK cycles once through all available URLs until it finds one that works correctly or until it has attempted all the available URLs; in the latter case, the PSDK no longer continues attempting to play the content.

Failover occurs only at the M3U8 level. This means:

• For VOD, failover can occur only when it begins attempting to play and not after it has started playing.
• For live streaming, failover can happen in the middle of the stream.

The PSDK player, rather than the Apple AV Foundation player, provides failover handling.

Primetime Player classes summary

You can use the Primetime Player Objective C API to customize the behavior of the player.

Media player classes

These classes describe your media player and its resources.

Class	Description
PTABRControlParameters	Encapsulates all adaptive bit-rate control parameters. Supported parameters are: • minBitRate • maxBitRate • initialBitRate
PTDefaultMediaPlayerClientFactory	Default implementation of `PTMediaPlayerClientFactory` in the PSDK. It provides the available `PTOpportunityResolver`, `PTContentResolver`, and `PTAdPolicySelector` instances.
PTMediaPlayer	Defines the root component for the Primetime Player framework. Applications create an instance of this class to play back a media. This component dispatches notifications to let your application know the status of the player at any given time.
PTMediaPlayerClientFactory	Protocol that describes the methods that a custom media player client factory should implement to provide the available `PTOpportunityResolver` , `PTContentResolver` and `PTAdPolicySelector` instances.
PTMediaPlayerItem	Represents a specific audio-video media.
PTMediaPlayerView	Manages the view component of the Primetime Player framework.
PTMediaProfile	Represents the profile of a single stream in the variant playlist.
PTMediaSelectionOption	Represents an audiovisual media resource to accommodate different language preferences, accessibility requirements, or custom application configurations. Valid option types: • Subtitles (PTMediaSelectionOptionTypeSubtitle) • Alternate audio (PTMediaSelectionOptionTypeAudio) • Undefined (PTMediaSelectionOptionTypeUndefined)

PTOpportunityResolver class, *PTOpportunityResolver* protocol	Class used for processing in-manifest cues that will be used as placements for the ad decisioning process.
PTOpportunityResolverDelegate	Protocol that describes the methods that the custom opportunity resolver (PTOpportunityResolver) should use to communicate to the delegate the status of the resolving of the opportunity.
PTSDK	Describes the version of the Primetime SDK and its capabilities.
PTSDKConfig	Exposes PSDK global settings and allows an application to subscribe to custom HLS tags.
PTTextStyleRule	Defines constants that represent text style attribute keys that form the dictionary of rules.

Logging classes

These classes enable you to customize logging.

Name	Description
PTLogEntry	Class. Defines an entry log and holds information about a log message.
PTLogFactory	Class that enables custom logging.
PTLogger	Protocol. The methods required to implement a custom logger for the PSDK.

Metadata classes

These classes provide metadata for advertising, namespaces, and tracking.

Name	Description
PTAdMetadata	Class that provides properties that should be configured for resolving ads for a given media item. All the required properties must be set to configure the player for successfully resolving ads.
PTAuditudeMetadata	Class that extends PTAdMetadata specifically for Ad Decisioning. Provides properties to be configured for resolving Ad Decisioning ads for a given media item. You must set all the required properties, including zone ID, media ID, and ad server URL, to configure the player for successfully resolving ads.
PTMetadata	Defines the base class for configuring all available metadata for your player and additional objects.
PTTimedMetadata	Class that represents a custom HLS tag in the stream.
PTTrackingMetadata	Defines a base class for all tracking and analytics related metadata.

Notification classes

These classes describe messages about errors, warnings, and some activities that the PSDK issues for logging and debugging purposes.

Class name	Description
PTMediaError	Class that describes the notification for an error that causes the player to stop playback. This is a *PTNotification* of notification type ERROR.
PTMediaPlayerNotifications	Lists all the notifications dispatched by the Primetime Player framework.
PTNotification	Class that provides informational messages, warnings, and errors. Encapsulates the object representation of a single notification event within *PTNotificationHistory*.
PTNotificationHistory	Class that stores a log of notification objects. A circular list of *PTNotificationHistoryItem* objects that provides access to a notification events history list. That is, it maintains a list of elements, each element containing a separate instance of the *PTNotification* class.
PTNotificationHistoryItem	Class that defines an entry in the circular list in *PTNotificationHistory* and holds the notification and its timestamp.

QoS classes

These classes provide information that help you to determine how well the player is performing.

Name	Description
PTDeviceInformation	Provides information about the platform and operating system on which the PSDK runs: • Version of the platform OS • Version number of the PSDK library • Device's model name • Device manufacturer's name • Device UUID • Width/height of the device screen
PTPlaybackInformation	Provides information on how the playback is performing. This includes the frame rate, the profile bit rate, the total time spent in buffering, the number of buffering attempts, the time it took to get the first byte from the first video fragment, the time it took to render the first frame, the currently buffered length, and the buffer time.
PTQoSProvider	Provides essential QoS metrics for both playback and the device.

Timeline classes

These classes provide information about the timeline of the particular media, including the placement of ads.

Name	Description
PTPlacementOpportunity	An opportunity class represents an "interesting" point on the timeline.
PTTimeline	Class that represents the timeline of the content, including ad breaks.

Timeline advertising classes

These classes provide information about ads that occur within a timeline.

Name	Description
PTAd	Class that defines the Ad abstraction and holds all ad information. It is defined by a unique ID, a duration, and a MediaResource. The MediaResource contains the URL where the actual ad content resides. Represents a primary linear asset spliced into the content. It can optionally contain an array of companion assets that must be displayed along with the linear asset.
PTAdAsset	Class that represents an asset to be displayed. Represents an asset to be displayed.
PTAdBannerView	Displays a banner asset. Your application must create a new instance of this utility class, set the banner asset, and add it to a view. The impression and click tracking for the banner is internally managed by this class.
PTAdBreak	Class that gives a unified view on several ads that will be played at some point during playback. Represents a continuous sequence of ads spliced into the content.
PTAdClick	Class that represents a click instance associated with an asset. This instance contains information about the click-through URL and the title that can be used to provide additional information to the user. Represents a click instance associated with an asset. This instance contains information about the click-through URL and the title that can be used to provide additional information to the user.
PTAdPolicyInfo	Protocol that defines properties for AdPolicySelector API calls. These properties provide the context for enforcing each ad behavior.
PTAdPolicySelector	An ad policy selector protocol for enforcing ad behaviors. Applications can conform to this protocol by implementing all the required methods or by extending the existing default policy selector class to customize specific behaviors.
PTAdTimeline	Class that represents the timeline of breaks within the content.
PTContentResolver class, *PTContentResolver* protocol	Class that handles the ad-resolving part in the Ad Decisioning process.
PTContentResolverDelegate	Protocol that describes the methods that the custom content resolver (`PTContentResolver`) should use to communicate to the delegate the status of the resolving of content.

Digital rights management classes

These classes provide information about DRM activity.

Class	Description
`PTDRMMetadataInfo`	Represents a specific DRM metadata instance.

Video Analytics classes

These classes provide the interface between the PSDK and Adobe Video Analytics.

Name	Description
PTSiteCatalystTrackingMetadata	Contains property metadata specific to Video Analytics tracking within the PSDK.
PTVideoAnalyticsTracker	Attaches the `PTMediaPlayer` instance to the VideoHeartbeat module for tracking the playback.
PTVideoAnalyticsTrackingMetadata	Contains property metadata specific to VideoHeartbeat tracking within the SDK.

Notification codes

The PSDK notification system includes various classes of notification events produced by the PSDK.

These notification events expose numerical codes that are grouped into ranges of integer values. The ranges provide two levels of classification.

Notification events are grouped in the following top-level classifications:

• Error notification events, from 100000 to 199999
• Warning notification events, from 200000 to 299999
• Information notification events, from 300000 to 399999

Inside each top-level range, subranges further classify notifications. Each subrange contains up to 1000 values, so each top-level range can contain up to 100 second-level subranges.

ERROR notification codes

Code	Name	InnerNotification	Metadata Keys	Comments
DRM				
100000	DRM_ERROR		MAJOR_DRM_CODE MINOR_DRM_CODE DESCRIPTION	
Playback				
101000	PLAYBACK_ERROR			
101001	NATIVE_PLAYBACK_ERROR	None	DESCRIPTION INTERNAL_ERROR URL	
101008	SEEK_ERROR	None	DESCRIPTION	An error has occurred while performing a seek operation.
101009	PAUSE_ERROR	None	None	An error has occurred while performing a pause operation.
101101	AUDIO_TRACK_CHANGE_FAIL	PLAYER_NOT_READY	None	
Invalid resource				

Code	Name	InnerNotification	Metadata Keys	Comments
102000	INVALID_MEDIA_PLAYER_ITEM	None	None	
Ad processing				
104001	AD_RESOLVER_METADATA_INVALID	AD_NOT_INSERTED	None	Ad resolving failed due to invalid ad-metadata format.
104005	AD_INSERTION_FAIL	AD_NOT_INSERTED	None	Ad resolving phase has failed.
104006	AD_UNREACHABLE	None	None	
Native				
106000	NATIVE_ERROR	None	INTERNAL_ERROR	A low-level iOS error occurred.
				May also be returned for DRM errors.
Configuration				
107002	SET_CC_VISIBILITY_ERROR	None	None	An error has occurred while attempting to change the visibility of the CC tracks.
107003	SET_CC_STYLING_ERROR	NATIVE_ERROR	None	An error has occurred while attempting to change the styling options for the CC tracks.
iOS specific				
170000	AD_HLS_VERSION_INCOMPATIBLE	AD_INSERTION_FAIL	None	The HLS version of the ads are highter than the HLS version of the content.
170001	ARGUMENT_ERROR	None	None	Argument error
170002	M3U8_PARSER_ERROR	None	DESCRIPTION	Could not parse m3u8.
170003	WEBVTT_PARSER_ERROR	None	None	Could not parse Webvtt.
170004	HLS_SEGMENT_ERROR	None	DESCRIPTION URL INTERNAL_ERROR	Segment exceeds specified bandwidth for variant.

Code	Name	InnerNotification	Metadata Keys	Comments
170005	MBR_MEDIASEQUENCE_OFFSYNC	None	None	The media sequence number is not on sync on all the HLS streams of this MBR.
170006	MISSING_FILE_ERROR	None	DESCRIPTION URL INTERNAL_ERROR	Missing file or not responding. HTTP 404: File not found.
170007	AD_EMPTY_RESPONSE	AD_INSERTION_FAIL	None	Could not retrieve ads. Empty response.
170008	AD_TIMEOUT	AD_INSERTION_FAIL	None	Could not retrieve ads. Timeout error.
170009	SUBTITLES_TRACK_CHANGE_FAIL	PLAYER_NOT_READY	None	Error while changing the subtitles track.
170010	SITECATALYST_ERROR	None	DESCRIPTION	Site catalyst error. See description.
170011	AD_TARGETDURATION_INCOMPATIBLE	AD_INSERTION_FAIL	None	The TARGET DURATION of the ad is higher than the TARGET DURATION of the content.

WARNING notification codes

Most warnings contain relevant metadata (for example, the URL of the resource that failed to be downloaded). Some warnings contain metadata to specify whether the problem occurred in the main video content, in the alternate audio content, or in an ad.

Code	Name	InnerNotification	Metadata Keys	Comments
iOS specific				
270000	PLAYER_NOT_READY	None	DESCRIPTION	
270001	AD_NOT_INSERTED	None	None	AD was not inserted on the stream.
270002	AD_HLS_AUDIOONLY_MISSING	AD_NOT_INSERTED	None	Ad does not contain Audio Only Stream
270003	AD_HLS_MATCHING_BITRATE_MISSING	AD_NOT_INSERTED	None	No matching ad stream found for content's current bitrate.

Code	Name	InnerNotification	Metadata Keys	Comments
270005	AVASSET_FAILED_TO_CREATE	PLAYBACK_ERROR	None	Error at creating the AVAsset.
270006	SITECATALYST_WARNING	None	DESCRIPTION	Warning: See sitecatalyst warning description.
270007	NETWORK_ERROR	None	URL	Error getting data from the network.

INFO notification codes

Code	Name	InnerNotification	Metadata Keys	Comments
Playback				
300000	PLAYBACK_START	None	None	Notifies that playback has started
300001	PLAYBACK_COMPLETE	None	None	Notifies that playback has completed
300002	SEEK_START	None	None	Notifies that a seek operation was initiated
300003	SEEK_COMPLETE	None	None	Notifies that a seek operation has completed.
300005	PLAYER_STATE_CHANGE	None	None	Notifies that the player state has changed. When state is ERROR, the inner notification is the error notification object that triggered the switch to the ERROR state.
Adaptive bit rates (ABR)				
302000	BITRATE_CHANGE	None	BITRATE	Notifies that the bitrate of the video has changed
Late-binding audio (LBA)				
304000	AUDIO_TRACK_CHANGE	None	None	Notifies that the audio track has been changed.
Subtitles				
307000	SUBTITLES_TRACK_CHANGE	None	None	Notifies that the subtitles track has changed

Glossary

A

ABR

Adaptive bit rate.

Based on the bandwidth conditions and the quality of playback (frame rate), the video engine automatically switches the quality level (bit rate) to provide the best playback experience.

ABR algorithm

The algorithm that determines which bit rate the client bandwidth can handle.

adaptive set

A set of renditions, typically from the same CDN. Within a set, renditions represent different bit rates.

ad break

One or more ads grouped to play in sequence. Even a single ad is enclosed in an ad break.

AVE

Adobe Video Engine.

C

CDN

Content delivery network.

cue point

An #EXT tag in an M3U8 manifest file that the PSDK uses for splicing ads into a live stream.

D

DRM

Digital rights management. Ensuring that content can be accessed or viewed only by users who have the appropriate permissions.

DVR

Digital video recorder.

F

full-event replay

A VOD asset that acts, in terms of ad insertion, as a live/DVR asset, so that your application must ensure that ads are placed correctly.

fragment

One segment of one representation of the media presentation.

H

HDS

HTTP Dynamic Streaming

This technology is from Adobe. The format works in OSMF 1.6 and later. HTTP Dynamic Streaming reproduces much of the functionality of RTMP delivery, providing the publisher a choice in delivery options. The primary benefit that HTTP offers is its ability to cache content, which is important for enterprise customers who deploy internal caching systems to optimize network usage.

HLS

HTTP Live Streaming

This Apple technology is a required format for delivery to Apple devices. It works in HTML5 browsers, AIR for iOS player, and native iOS apps.

I

iframe

An HTML iframe. An inline frame places another HTML document in a frame. An inline frame can be the target frame for links (URLs) defined by other elements, and it can be selected by the user agent as the focus for printing, viewing its source, and so on. The content of the element is used as alternative text to be displayed if the browser does not support iframes.

I-frame

In video compression, an I-frame (also called a key frame) is an Intra-coded picture, in effect a fully specified picture, like a conventional static image file. P-frames and B-frames hold only part of the image information, so they need less space to store than an I-frame, and thus improve video compression rates.

K

key frame

See I-frame.

L

linear video

Linear video is streamed video with advertisements already stitched into the stream. An example of linear video could be a programmed television show.

live video

Video that is being streamed from a live event. Advertisements are typically overlaid on live video. An example of live video could be a live sporting event.

M

main content

Represents the movie or streaming video.

MBR

Multiple bit rate. A video asset that has more than one bit-rate rendition available.

manifest

An M3U8 document/file that defines the protocol for transferring multimedia data streams, including specifying the data format and the actions to be taken by the sender and the receiver. Also called a playlist.

multiplexed

Audio and video are contained in the same rendition rather than in separate renditions.

muxed

Multiplexed.

N

national ads

Ads that are placed in the main content, but not targeted.

P

PHDS

Protected HTTP Dynamic Streaming.

PHLS

Protected HTTP Live Streaming.

playlist

See manifest.

Q

QoS

Quality of service.

R

rendition

One representation of the media presentation.

RTA

Real-time analytics.

S

SBR

Single bit rate.

segment

See fragment.

T

targeted ads

Ads that are served to a user based on received information about that user.

V

VOD

Video on demand.

Video that you watch at your convenience. An example of VOD is a video that you can download on your device from a video publishing service.

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