AVKit for tvOS

Interactive video playback

Session 506

Dan Wright AVKit Engineer

Video Playback on Apple TV

Video Playback on Apple TV

Siri remote: Touch surface

Video Playback on Apple TV

Siri remote: Touch surface

Siri voice commands

Video Playback on Apple TV

Siri remote: Touch surface

Siri voice commands

Older Apple TV remotes

Video Playback on Apple TV

Siri remote: Touch surface

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iOS Remote app

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iOS Remote app

Bluetooth keyboards

Game controllers

Video Playback on Apple TV

Siri remote: Touch surface

Siri voice commands

Older Apple TV remotes

iOS Remote app

Bluetooth keyboards

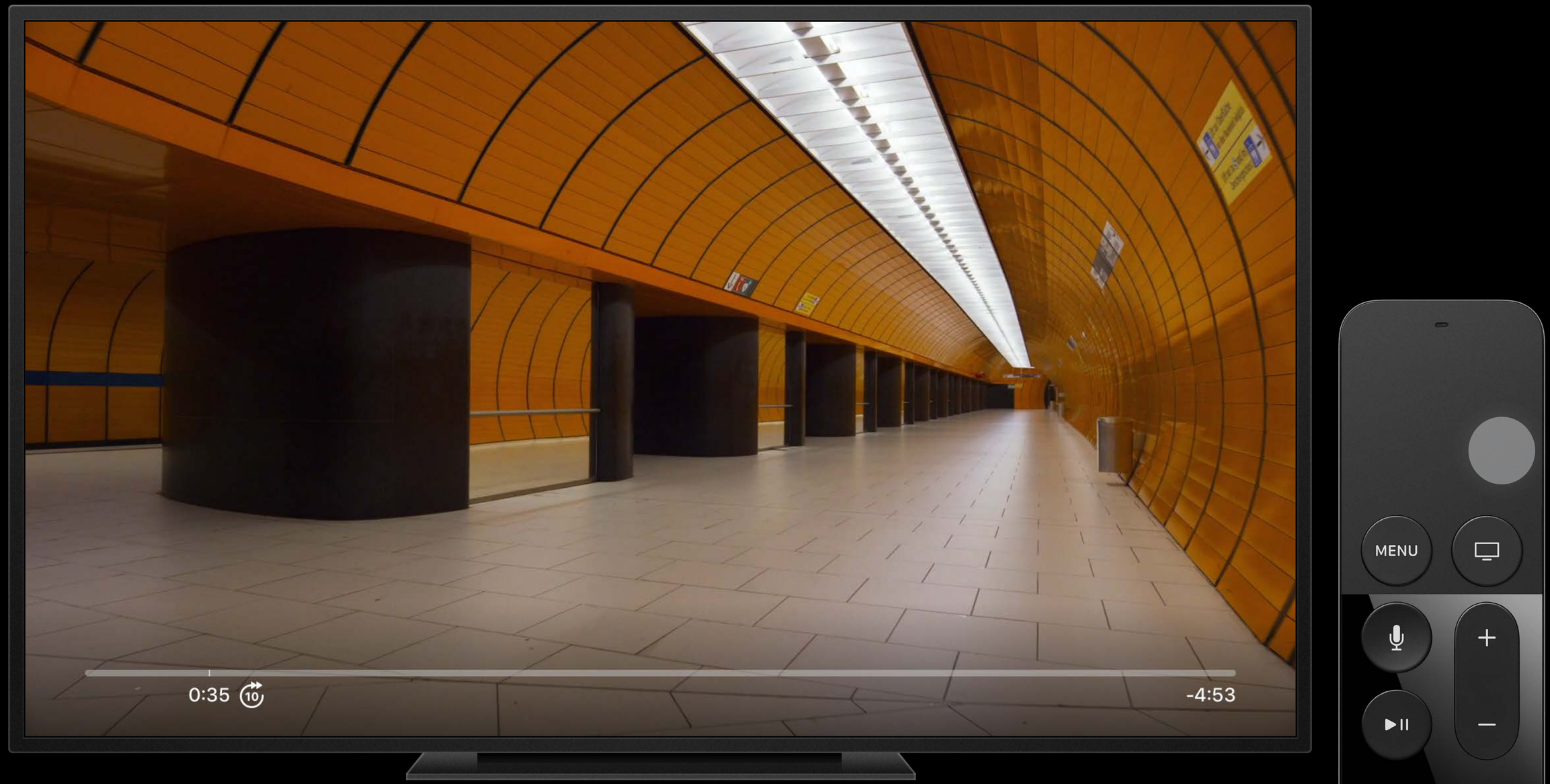
Game controllers

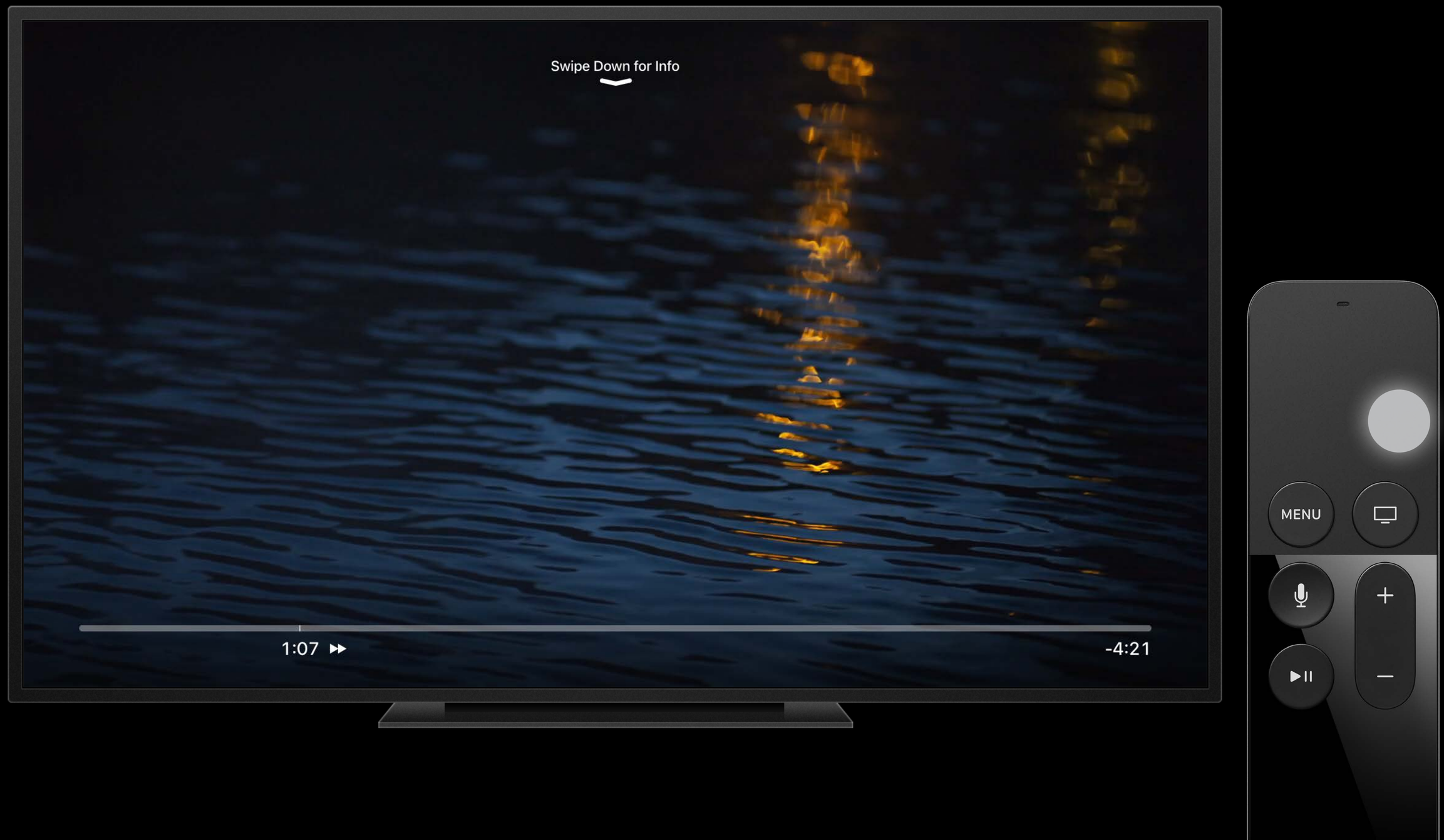
Infrared universal remotes

Introducing AVKit for tvOS

Modern playback with a consistent user experience


1:36
-3:52
MENU


0:35
10
-4:53
MENU


Swipe Down for Info
1:07
-4:21
MENU


MENU
3:07
1:21
-2:21

Info Audio

Scenic Landscapes

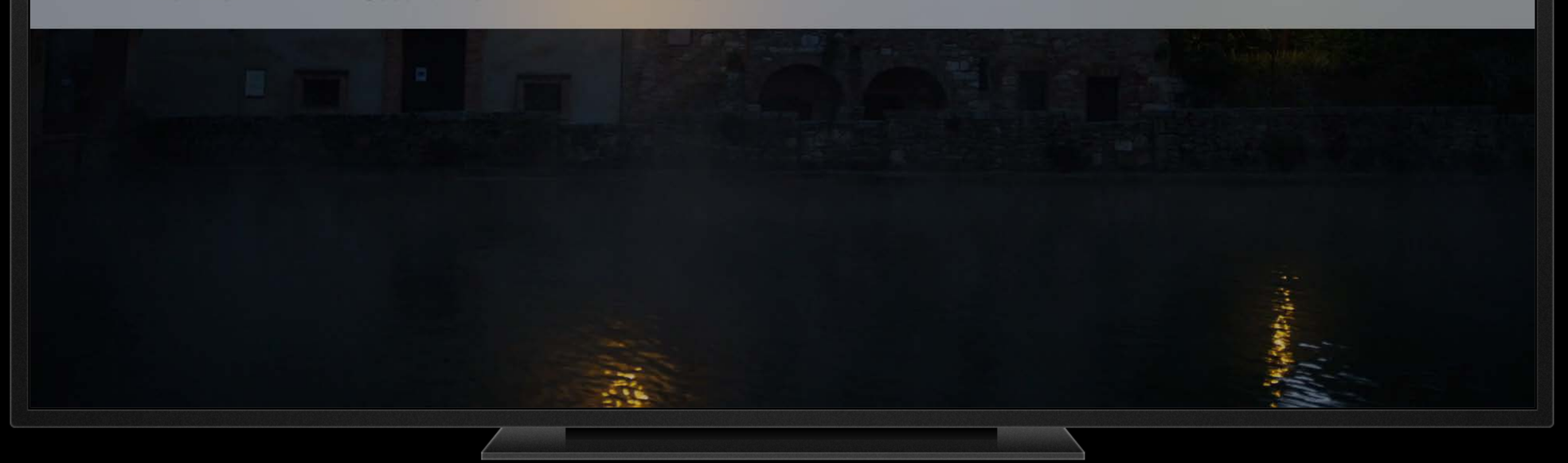
5 min C

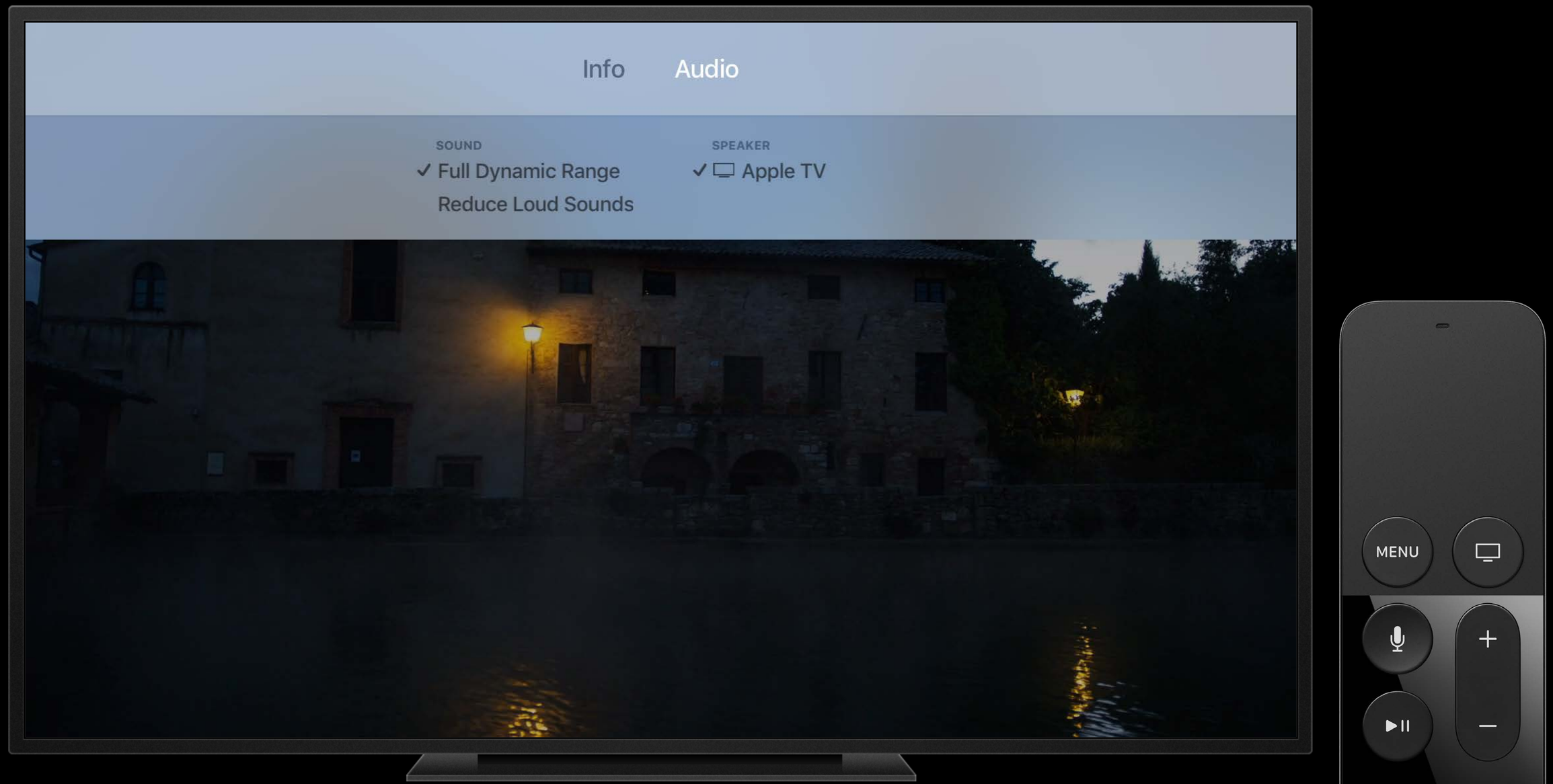
In this episode we will explore beautiful scenery from around the world. We will see breathtaking views of mountains, fields, sunsets, and cities from some spectacular places on this planet.

First Event

Second Event

Third Event




Info
Audio
SOUND
✓ Full Dynamic Range
Reduce Loud Sounds
SPEAKER
✓ Apple TV
MENU

Siri…

“Go back to the beginning”

“Skip ahead 10 minutes”

“*What* did she say?”

“Switch to French”

1:36

-3:52

Modern Media Stack

Same on tvOS, iOS, and macOS

Modern Media Stack

Same on tvOS, iOS, and macOS

AVKit

Modern Media Stack

Same on tvOS, iOS, and macOS

AVKit

AVFoundation

CoreMedia

Modern Media Stack

Same on tvOS, iOS, and macOS

AVKit

AVFoundation

UIKit/AppKit

CoreMedia

Agenda

Agenda

Getting Started with AVKit

Agenda

Getting Started with AVKit

Extending Playback with Features Unique to tvOS

Agenda

Getting Started with AVKit

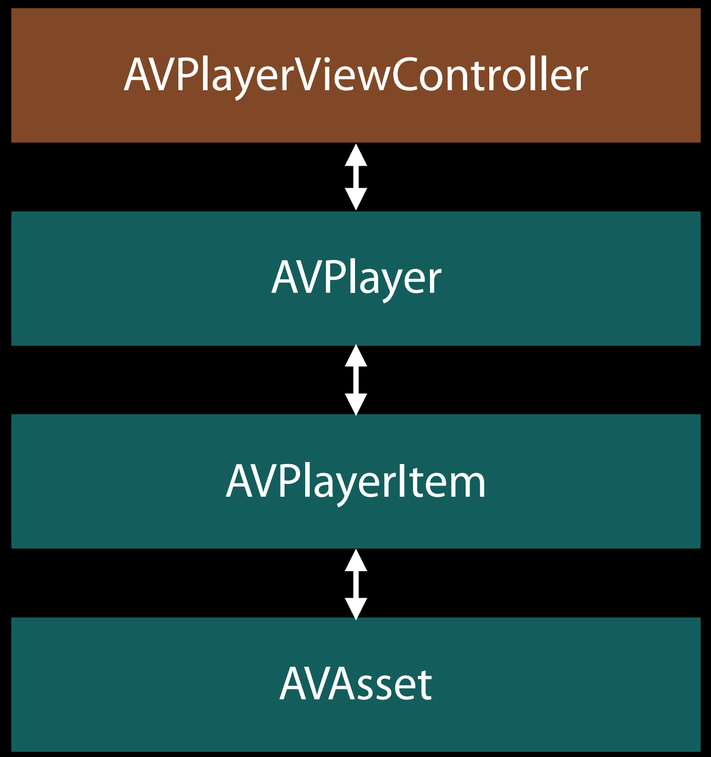
Extending Playback with Features Unique to tvOS

Best Practices

Getting Started with AVKit

AVPlayerViewController

AVFoundation and AVKit basics



Providing Content

Steps to provide content for AVPlayerViewController

Providing Content

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```
// 1. Create asset from a URL
let asset = AVAsset(url: url)
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Providing Content

Steps to provide content for AVPlayerViewController

```
// 1. Create asset from a URL
let asset = AVAsset(url: url)

// 2. Create a playerItem with the asset
let playerItem = AVPlayerItem(asset: asset)
```

Providing Content

Steps to provide content for AVPlayerViewController

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// 1. Create asset from a URL
let asset = AVAsset(url: url)

// 2. Create a playerItem with the asset
let playerItem = AVPlayerItem(asset: asset)

// 3. Create a player with the playerItem
let player = AVPlayer(playerItem: playerItem)
```

Providing Content

Steps to provide content for AVPlayerViewController

```
// 1. Create asset from a URL
let asset = AVAsset(url: url)

// 2. Create a playerItem with the asset
let playerItem = AVPlayerItem(asset: asset)

// 3. Create a player with the playerItem
let player = AVPlayer(playerItem: playerItem)

// 4. Associate player with player view controller
playerViewController.player = player
```

Providing Content

In one line of code

```
// All four steps in one line of code.
playerViewController.player = AVPlayer(url: url)
```

Embedding an Inline Player

For noninteractive playback

Embedding an Inline Player

For noninteractive playback

```
// 1. Set up playerViewController
let playerViewController = AVPlayerViewController()
playerViewController.player = AVPlayer(url: url)
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Embedding an Inline Player

For noninteractive playback

```
// 1. Set up playerViewController
let playerViewController = AVPlayerViewController()
playerViewController.player = AVPlayer(url: url)


// 2. Set its frame to the inline view (use constraints!)
playerViewController.view.frame = inlineVideoRect
```

Embedding an Inline Player

For noninteractive playback

```
// 1. Set up playerViewController
let playerViewController = AVPlayerViewController()
playerViewController.player = AVPlayer(url: url)

// 2. Set its frame to the inline view (use constraints!)
playerViewController.view.frame = inlineVideoRect

// 3. Add it to your view
myViewController.view.addSubview(playerViewController.view)
myViewController.addChildViewController(playerViewController)
```

Interactive Full-Screen Presentation

For full-user interaction

```
// If the view was embedded, it will zoom automatically
myViewController.present(playerViewController, animated:true, completion:nil)
```

Extending the Playback Experience

Advanced features of AVKit on tvOS

Extending the Playback Experience

Introduced in tvOS 9.0

Extending the Playback Experience

Introduced in tvOS 9

Adding noninteractive overlays

Extending the Playback Experience

Introduced in tvOS 9

Adding noninteractive overlays

Restricting playback interaction (`requiresLinearPlayback`)

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Providing informational metadata

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Extending the Playback Experience

Introduced in tvOS 9

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Identifying interstitial content

Extending the Playback Experience

New in tvOS 10

NEW

Extending the Playback Experience

New in tvOS 10

NEW

Changing skipping behavior

Extending the Playback Experience

New in tvOS 10

NEW

Changing skipping behavior

Presenting content proposals

Overlays

For logos and other overlaid graphics

The playback overlay view lies above the video, but below the controls

Overlays

For logos and other overlaid graphics

The playback overlay view lies above the video, but below the controls

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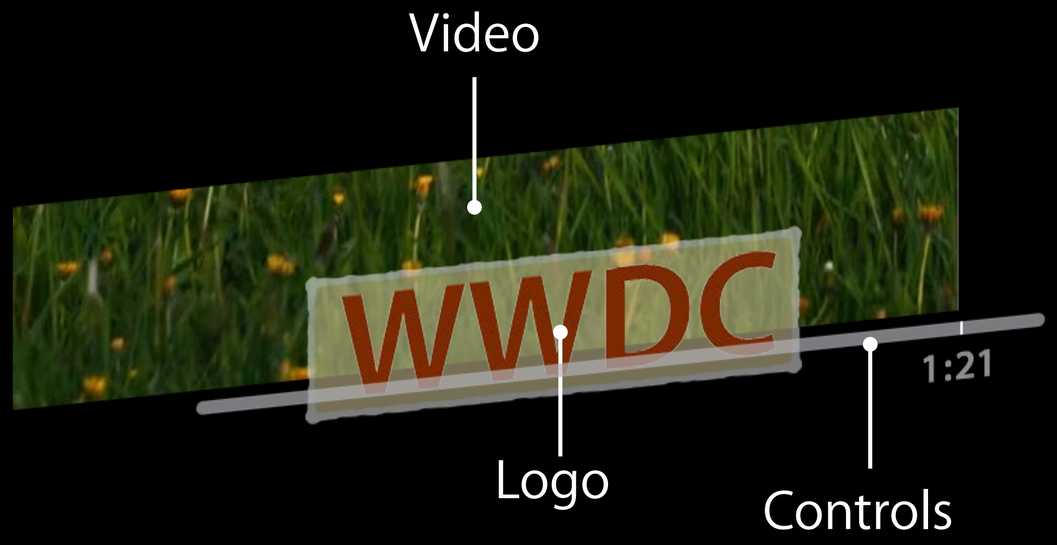

Overlays

For logos and other overlaid graphics

The playback overlay view lies above the video, but below the controls

Views may be static or animated

Overlays

For logos and other overlaid graphics

The playback overlay view lies above the video, but below the controls

Views may be static or animated

Views will not receive focus/events

Restricting Playback

Restricting playback interaction (`requiresLinearPlayback`)

User interaction is limited to play/pause

- Fast-forward, scrubbing, and skipping are forbidden

External Metadata

The `externalMetadata` property of `AVPlayerItem` supplements or replaces embedded information:

- Title
- Description
- Genre (Drama, Comedy)
- Media content rating
- Poster artwork

Info Audio

Scenic Landscapes

5 min C

In this episode we will explore beautiful scenery from around the world. We will see breathtaking views of mountains, fields, sunsets, and cities from some spectacular places on this planet.

First Event

Second Event

Third Event

Info Audio

Scenic Landscapes

5 min (G)

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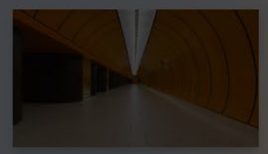
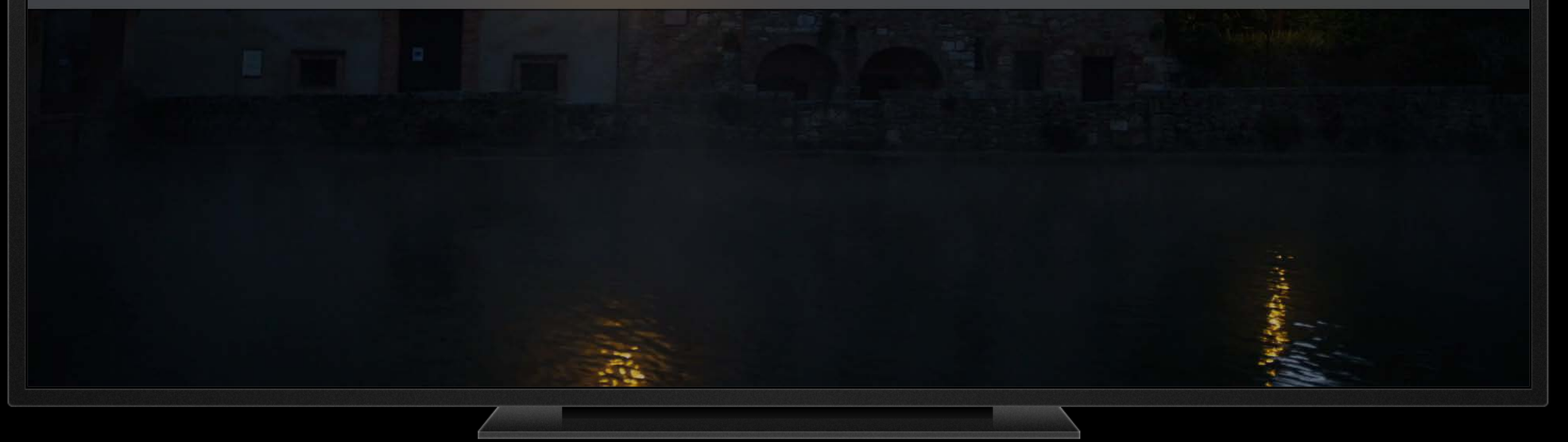
First Event



Second Event

Third Event



External Metadata

Creating external metadata items

```
func metadataItem(identifier : String, value : protocol<NSCopying,
      NSObjectProtocol>?) -> AVMetadataItem? {
   if let actualValue = value {
      let item = AVMutableMetadataItem()
      item.value = actualValue
      item.identifier = identifier
      item.extendedLanguageTag = "und" // undefined (wildcard) language
      return item.copy() as? AVMetadataItem
   }
   return nil
}
```

External Metadata

Creating external artwork items

```
func metadataArtworkItem(image: UIImage) -> AVMetadataItem? {
    let item = AVMutableMetadataItem()
    // Choose PNG or JPEG
    item.value = UIImagePNGRepresentation(image)
    item.dataType = kCMMetadataBaseDataType_PNG as String
    item.identifier = AVMetadataCommonIdentifierArtwork
    item.extendedLanguageTag = "und"
    return item.copy() as? AVMetadataItem
}
```

External Metadata

Creating external artwork items

```
var allItems : [AVMetadataItem] = []

allItems.append(metadataItem(identifier: AVMetadataCommonIdentifierTitle,
   value: "The Title”)!)

allItems.append(metadataItem(identifier:
   AVMetadataCommonIdentifierDescription, value:
   "Your description goes here.”)!)

if let artworkItem = metadataItem(posterImage) {
   allItems.append(artworkItem)
}

allItems.append(metadataItem(identifier:
   AVMetadataIdentifierQuickTimeMetadataGenre, value: “Comedy”)!)

playerItem.externalMetadata = allItems
```

Info Audio

Scenic Landscapes

5 min C

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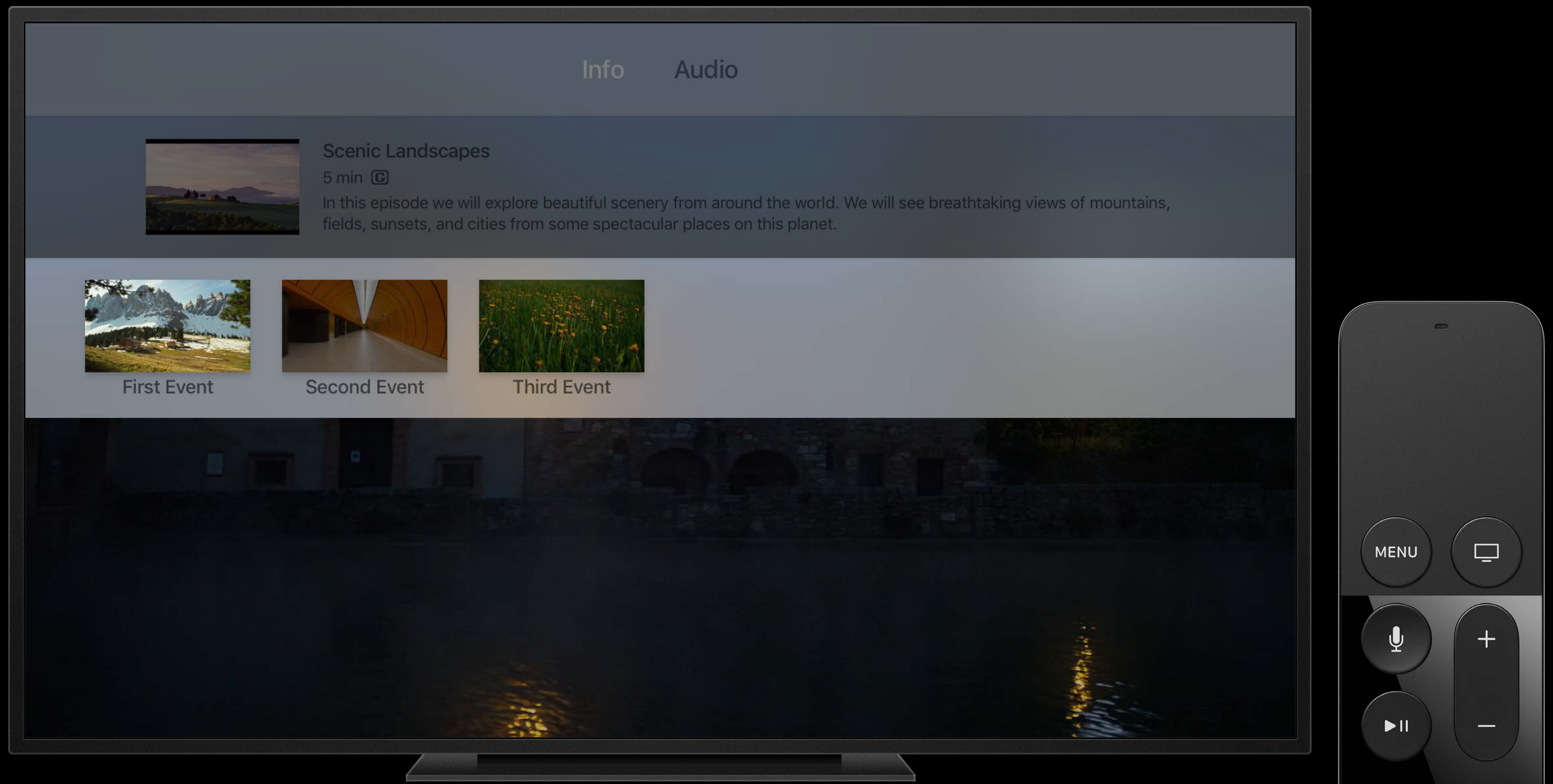

Info
Audio
Scenic Landscapes
5 min
G
In this episode we will explore beautiful scenery from around the world. We will see breathtaking views of mountains, fields, sunsets, and cities from some spectacular places on this planet.
First Event
Second Event
Third Event
MENU

Navigation Marker Groups

For chapters and events

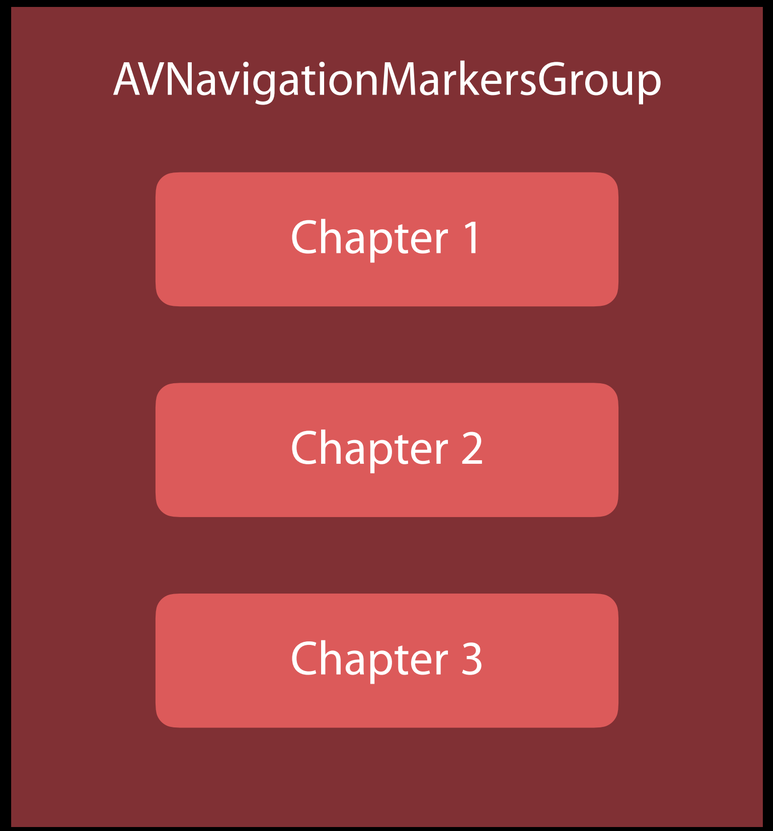
Used for chapters or to identify interesting events

- Events might include things such as scoring or game highlights

Viewers can easily navigate to markers

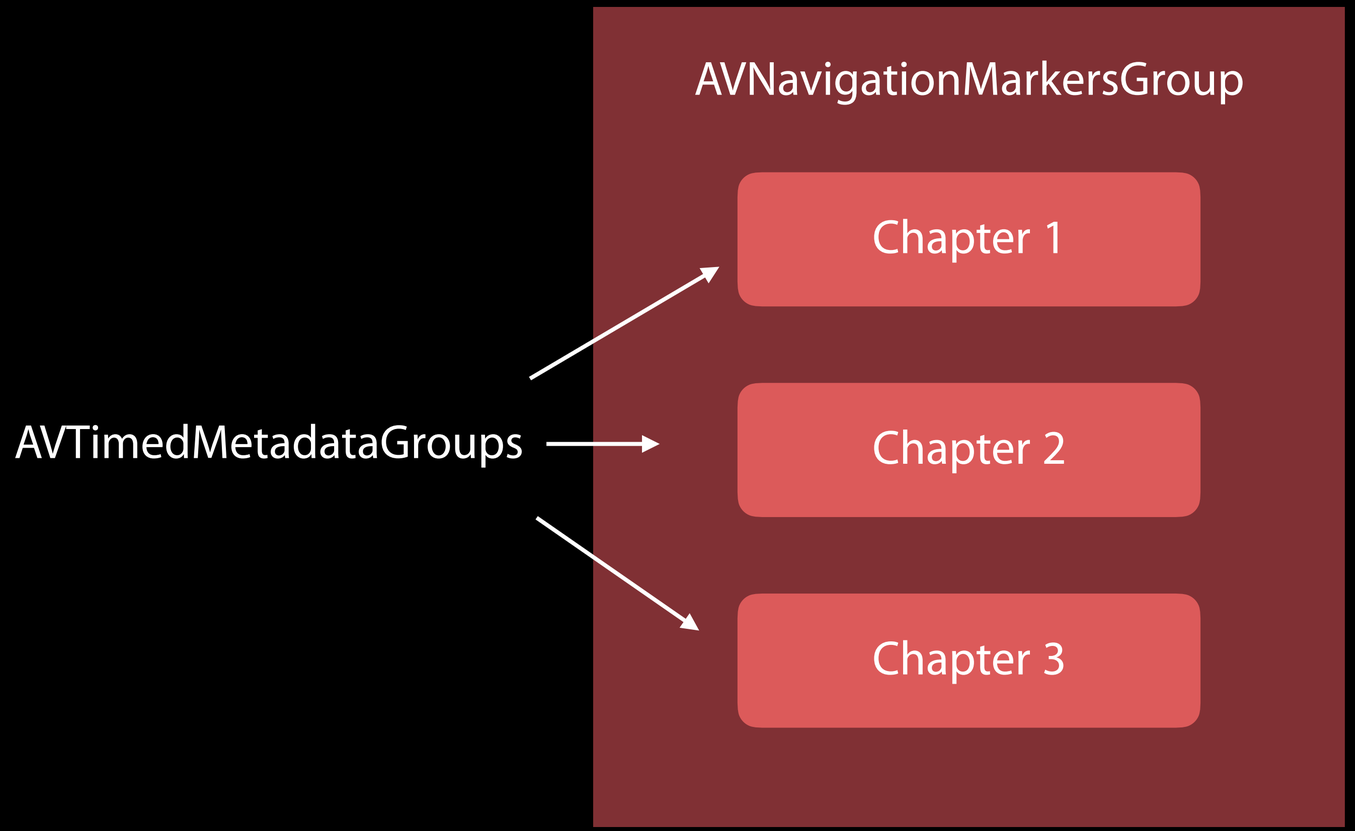
Navigation Marker Groups

For easy navigation of chapters and events



Navigation Marker Groups

For easy navigation of chapters and events



Navigation Marker Groups

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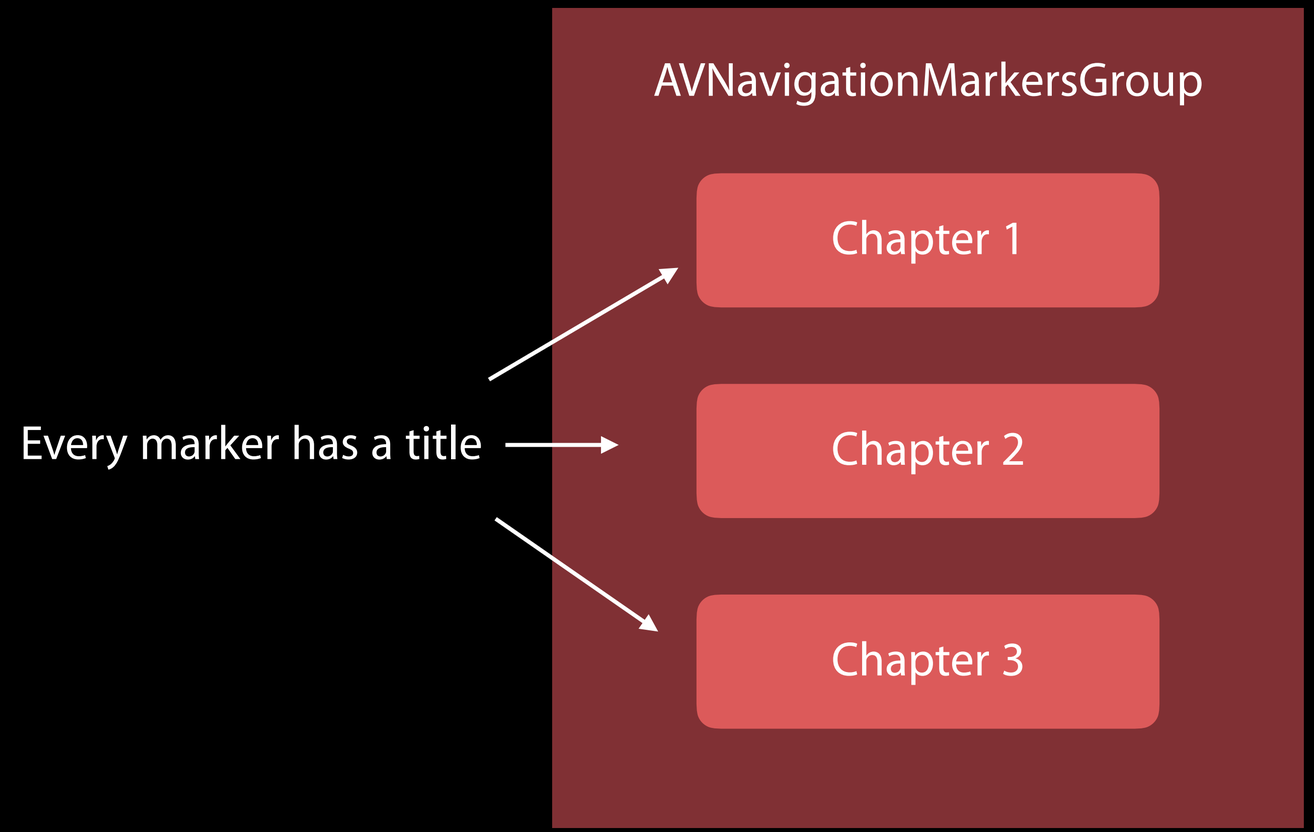
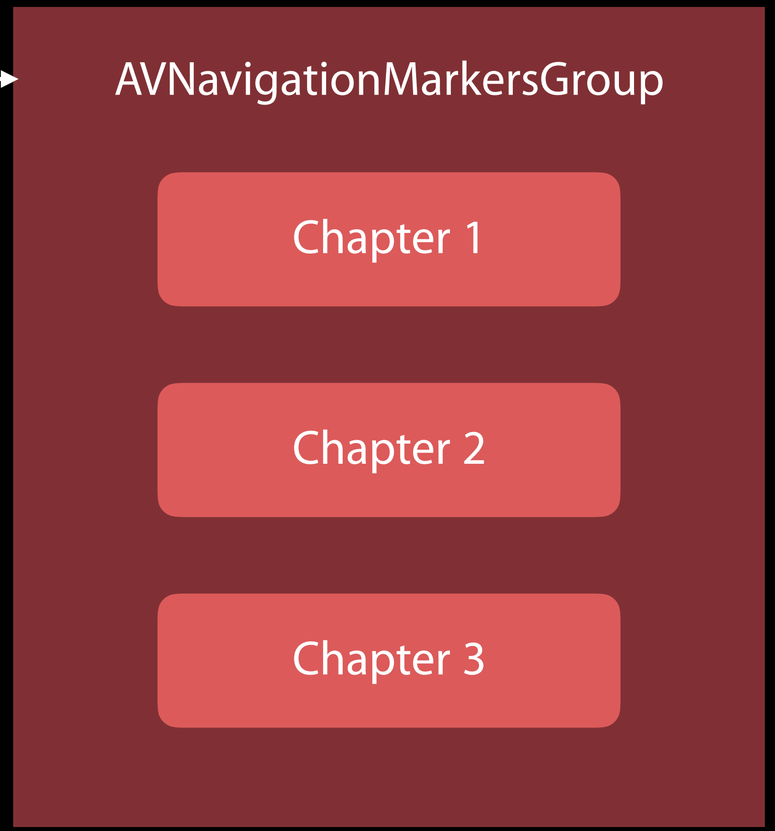


Navigation Marker Groups

For easy navigation of chapters and events

An event group has a title; a chapter group does not



Navigation Marker Groups

Creating navigation markers

```
func navigationMarker(title : String, description : String, timeRange :
      CMTimeRange) -> AVTimedMetadataGroup {
   var items : [AVMetadataItem] = []
   if let titleItem = metadataItem(identifier:
      AVMetadataCommonIdentifierTitle, value: title) {
         items.append(titleItem)
   }
   if let descriptionItem = metadataItem(identifier:
      AVMetadataCommonIdentifierDescription, value: description) {
         items.append(descriptionItem)
   }
   return AVTimedMetadataGroup(items: items, timeRange: timeRange)
}
```

Navigation Marker Groups

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   var items : [AVMetadataItem] = []
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Navigation Marker Groups

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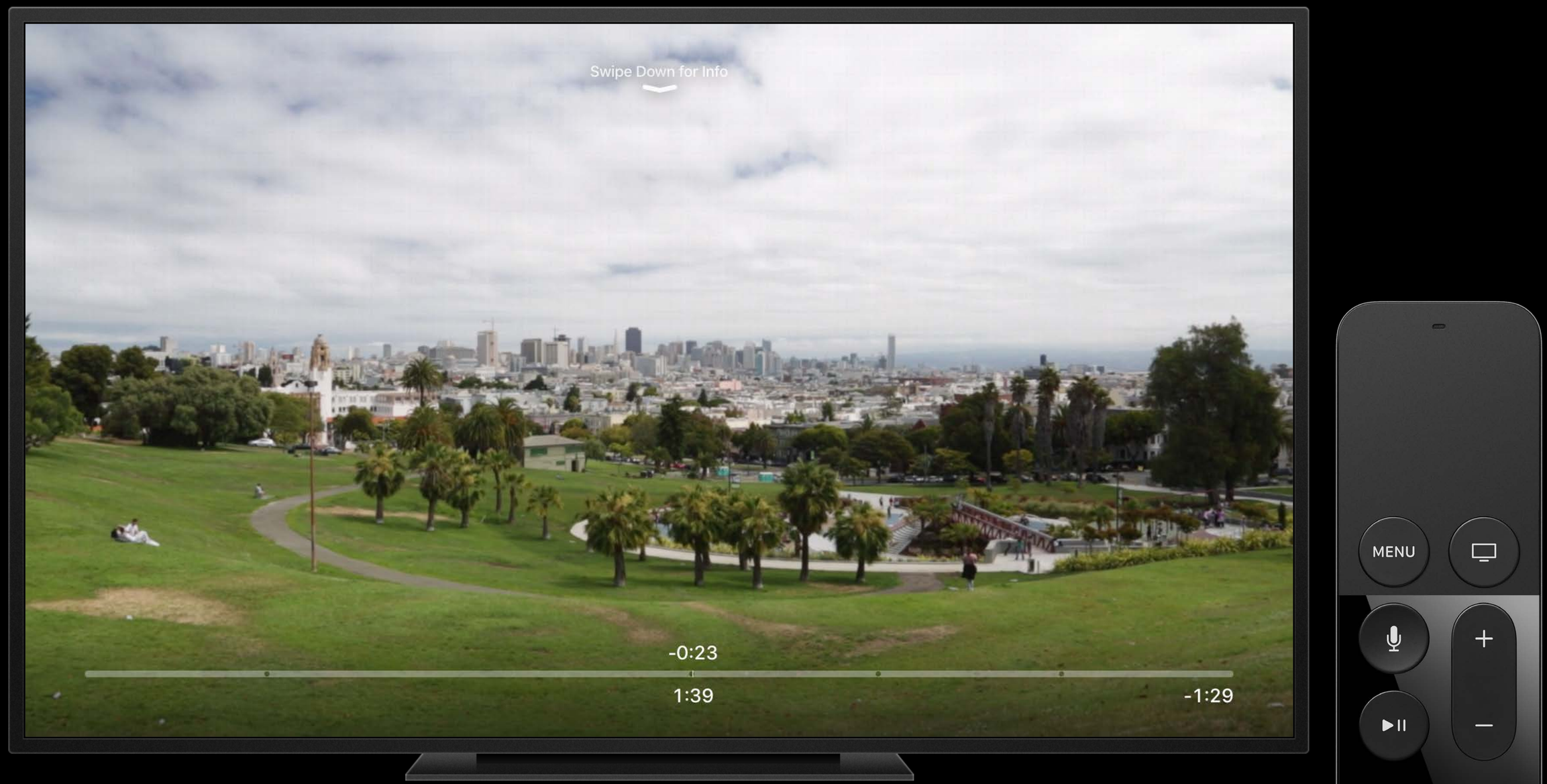
      AVMetadataCommonIdentifierDescription, value: description) {
         items.append(descriptionItem)
   }
   return AVTimedMetadataGroup(items: items, timeRange: timeRange)
}
```


Swipe Down for Info
-0:23
1:39
-1:29
MENU


Swipe Down for Info
-0:23
1:39
-1:29
MENU


Swipe Down for Info
-0:23
1:39
-0:23
1:39
-1:29
MENU

Interstitial Content

Collapsing content unrelated to the main video

Interstitial Content

Collapsing content unrelated to the main video

Typically unrelated to the main media

Interstitial Content

Collapsing content unrelated to the main video

Typically unrelated to the main media

An interstitial time range identifies a portion of an asset

Interstitial Content

Collapsing content unrelated to the main video

Typically unrelated to the main media

An interstitial time range identifies a portion of an asset

Interstitial time ranges collapse into dots on the transport bar

Interstitial Content

Collapsing content unrelated to the main video

Typically unrelated to the main media

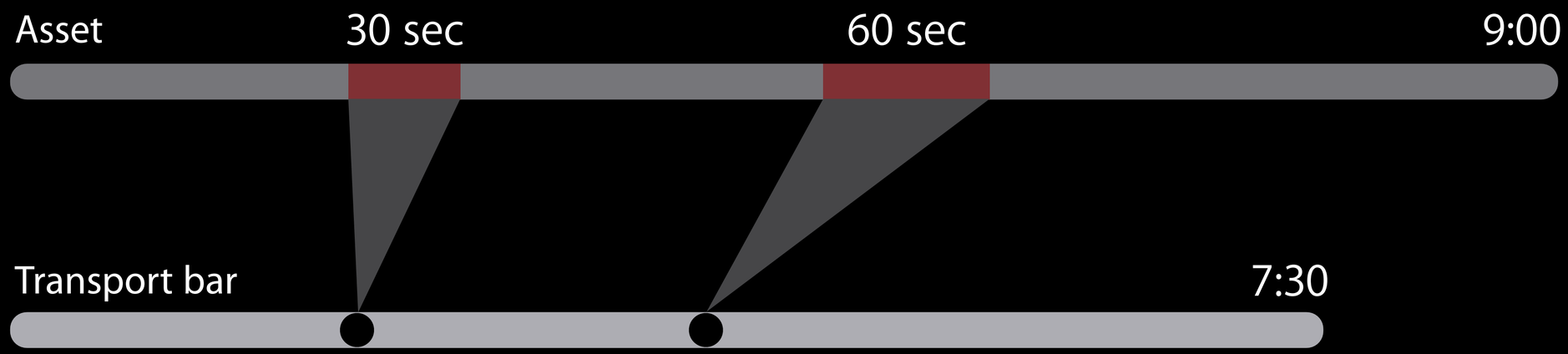
An interstitial time range identifies a portion of an asset

Interstitial time ranges collapse into dots on the transport bar

During scrubbing, interstitial content is hidden

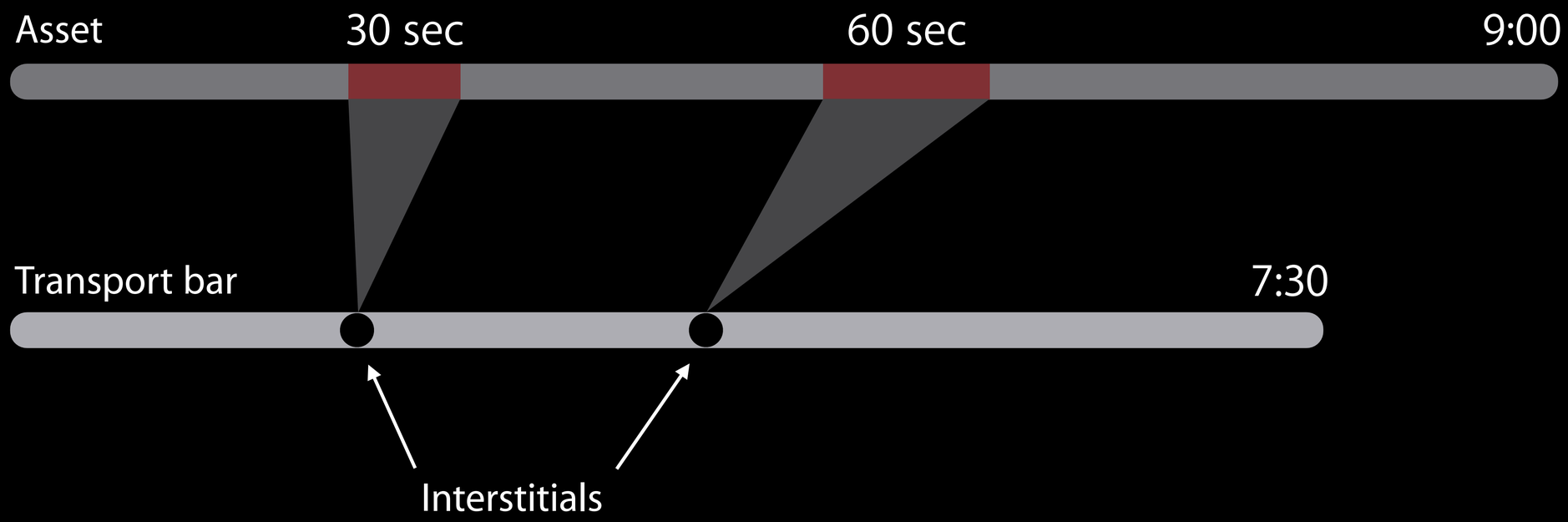
Interstitials

Identifying the asset time ranges



Interstitials

Identifying the asset time ranges



Interstitial Content

Creating and declaring

Interstitial Content

Creating and declaring

Interstitial content should be stitched into your asset on your server (HLS)

Interstitial Content

Creating and declaring

Interstitial content should be stitched into your asset on your server (HLS)

Declare interstitial time ranges

Interstitial Content

Creating and declaring

Interstitial content should be stitched into your asset on your server (HLS)

Declare interstitial time ranges

Implement delegate methods to enforce playback policy

Interstitial Content

Declaring interstitial time ranges

```
var interstitialTimeRanges = [AVInterstitialTimeRange]()

let start = CMTime(seconds: startInterval, preferredTimescale: 1000)
let duration = CMTime(seconds: durationInterval, preferredTimescale: 1000)

let interstitialTimeRange = AVInterstitialTimeRange(timeRange:
   CMTimeRange(start: start, duration: duration))

interstitialTimeRanges.append(interstitialTimeRange)

myPlayerItem.interstitialTimeRanges = interstitialTimeRanges
```

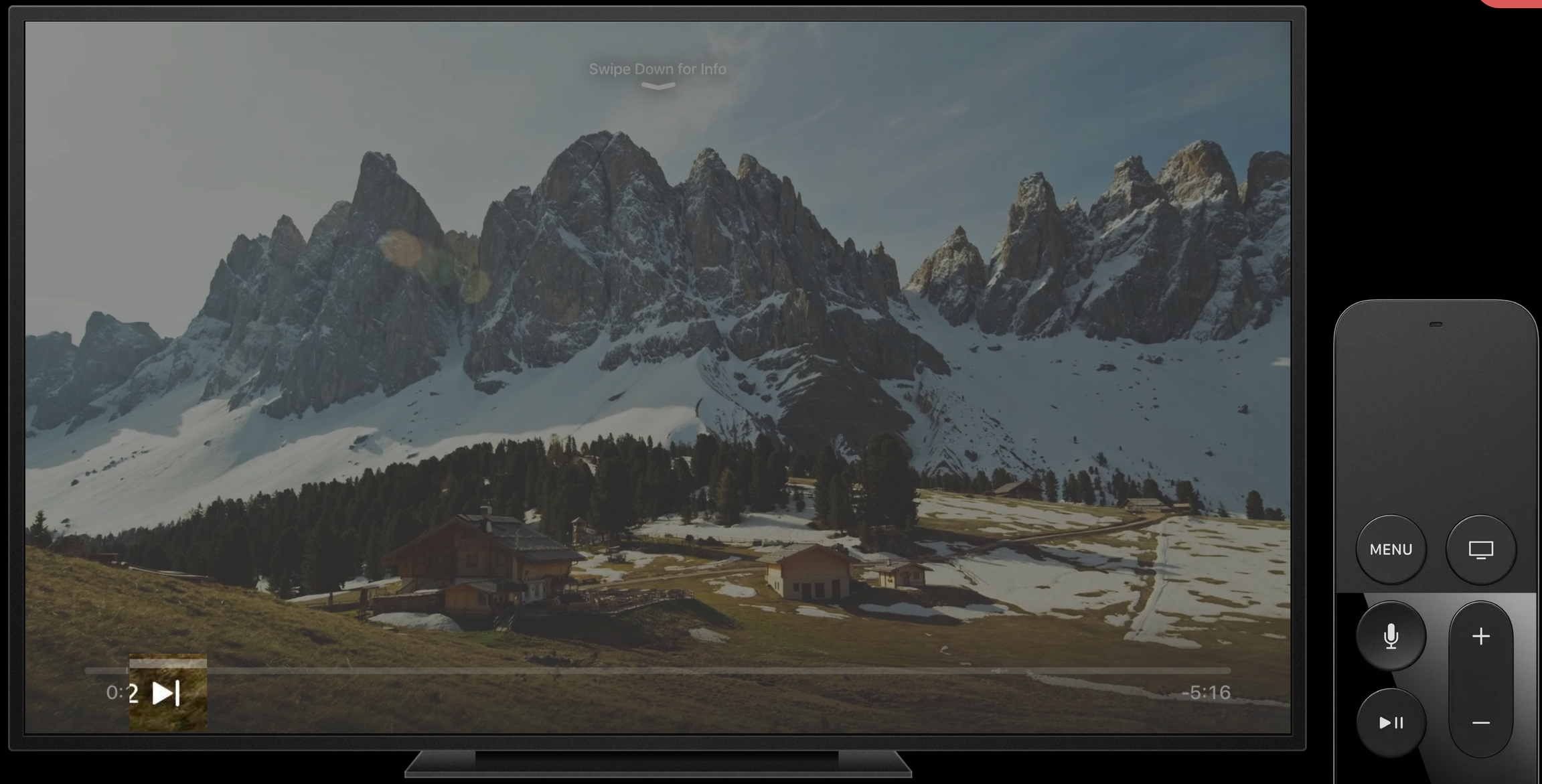
```
func playerViewController(playerViewController:
   AVPlayerViewController, willPresent interstitial: AVInterstitialTimeRange)
{
   // Prevent user navigation inside interstitials
   playerViewController.requiresLinearPlayback = true
}
```

```
func playerViewController(playerViewController:
    AVPlayerViewController, willPresent interstitial: AVInterstitialTimeRange)
{
    // Prevent user navigation inside interstitials
    playerViewController.requiresLinearPlayback = true
}
func playerViewController(playerViewController:
    AVPlayerViewController, didPresent interstitial: AVInterstitialTimeRange)
{
    // Allow user navigation outside interstitials
    playerViewController.requiresLinearPlayback = false
}
```

```
func playerViewController(playerViewController:
    AVPlayerViewController, willPresent interstitial: AVInterstitialTimeRange)
{
    // Prevent user navigation inside interstitials
    playerViewController.requiresLinearPlayback = true
}
func playerViewController(playerViewController:
    AVPlayerViewController, didPresent interstitial: AVInterstitialTimeRange)
{
    // Allow user navigation outside interstitials
    playerViewController.requiresLinearPlayback = false
}
func playerViewController(playerViewController: AVPlayerViewController,
    timeToSeekAfterUserNavigatedFrom oldTime: CMTime, to targetTime: CMTime)
    -> CMTime {
    // Alter this time to redirect to an interstitial
    let interstitialStartTime = startTimeOfSkippedInterstice(oldTime, to:
        targetTime)
    return interstitialStartTime.isValid ? interstitialStartTime : targetTime
}
```

NEW

NEW



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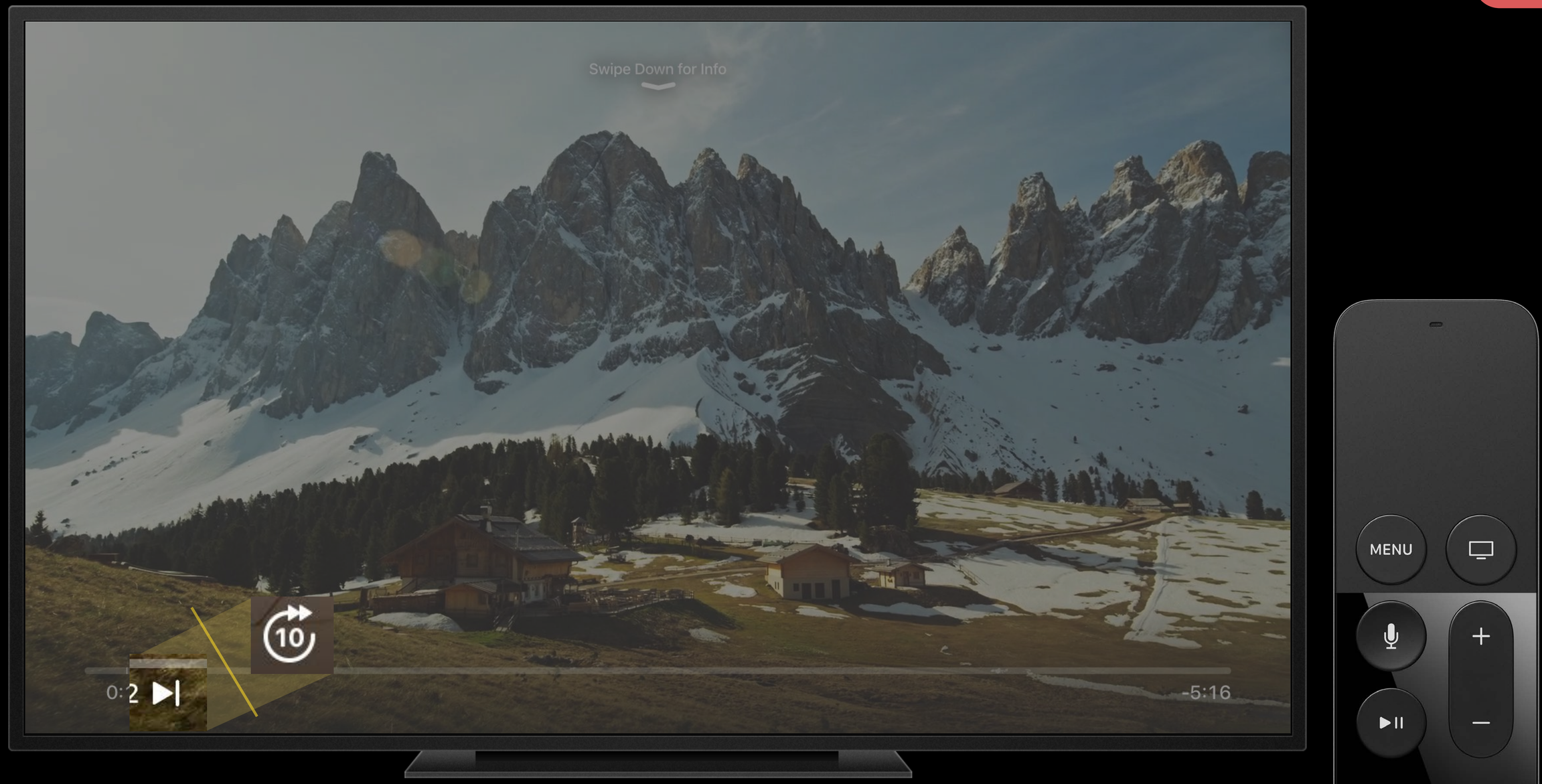

Skipping Behavior

Modifying the actions associated with skipping

NEW

```
public enum AVPlayerViewControllerSkippingBehavior : Int {
    case `default`
    case skipItem
}

extension AVPlayerViewController {
    public var skippingBehavior: AVPlayerViewControllerSkippingBehavior
    public var isSkipForwardEnabled: Bool
    public var isSkipBackwardEnabled: Bool
}
```

Skipping Behavior

Modifying the actions associated with skipping

NEW

```
// Skip by-item instead of skip +/- a few seconds
playerViewController.skippingBehavior = .skipItem
playerViewController.isSkipForwardEnabled = true
playerViewController.isSkipBackwardEnabled = true

// Delegate methods respond to skipping by-item
func skipToNextItem(for playerViewController: AVPlayerViewController) {
    let nextPlayerItem = AVPlayerItem(url: nextUrl)
    playerViewController.player?.replaceCurrentItem(nextPlayerItem)
}

func skipToPreviousItem(for playerViewController:
    AVPlayerViewController) {
    playerViewController.player?.replaceCurrentItem(AVPlayerItem(url:prevUrl))
}
```

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    playerViewController.player?.replaceCurrentItem(AVPlayerItem(url:prevUrl))
}
```

Demo

Basic playback with AVKit

Jonathan Long AVKit Engineer

Content Proposals

Suggesting what to watch next

NEW

NEW

Episode 2 - More Scenic Beauties

Play Next

Return To Video

In this episode we will explore beautiful scenery from around the world. we will see breathtaking views of mountains, fields, sunsets, and cities from some spectacular places on this planet.

NEW

Episode 2 - More Scenic

To Video

In this episode we will explore beautiful scenery from around the world. we will see breathtaking views of mountains, fields, sunsets, and cities from some spectacular places on this planet.

NEW

Current
Video

Episode 2 - More Scenic

To Video

In this episode we will explore beautiful scenery from around the world. we will see breathtaking views of mountains, fields, sunsets, and cities from some spectacular places on this planet.

NEW

Play Next

Return To Video

is episode we will explore beautiful scenery from around the world. we will see
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MENU

NEW

Proposed Video

Play Next

Return To Video

is episode we will explore beautiful scenery from around the world. we will see
thtaking views of mountains, fields, sunsets, and cities from some spectacular places
his planet.

Content Proposals

Suggesting what to watch next

NEW

```
public class AVContentProposal : NSObject, NSCopying {
    public var contentTimeForTransition: CMTime { get }
    public var automaticAcceptanceInterval: TimeInterval
    public var title: String { get }
    public var previewImage: UIImage? { get }
    public var url: URL?
    public var metadata: [AVMetadataItem]
    public init(contentTimeForTransition: CMTime, title: String, previewImage: UIImage?)
}
extension AVPlayerItem {
  public var nextContentProposal: AVContentProposal?
}
```

Content Proposals

Suggesting what to watch next

NEW

```
public class AVContentProposal : NSObject, NSCopying {
    public var contentTimeForTransition: CMTime { get }
    public var automaticAcceptanceInterval: TimeInterval
    public var title: String { get }
    public var previewImage: UIImage? { get }
    public var url: URL?
    public var metadata: [AVMetadataItem]
    public init(contentTimeForTransition: CMTime, title: String, previewImage: UIImage?)
}
extension AVPlayerItem {
  public var nextContentProposal: AVContentProposal?
}
```

Content Proposals

Suggesting what to watch next

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Content Proposals

Creating the content proposal

NEW

```
// Create the proposal
```

Content Proposals

Creating the content proposal

NEW

```
// Create the proposal
let contentProposal = AVContentProposal(contentTimeForTransition:
    kCMTimeZero, title: "Happy Hijinks S9 E2", previewImage: previewImage)
```

Content Proposals

Creating the content proposal

NEW

```
// Create the proposal
let contentProposal = AVContentProposal(contentTimeForTransition:
   kCMTimeZero, title: "Happy Hijinks S9 E2", previewImage: previewImage)
contentProposal.url = urlForHappyHijinksS9E2
```

Content Proposals

Creating the content proposal

NEW

```
// Create the proposal
let contentProposal = AVContentProposal(contentTimeForTransition:
   kCMTimeZero, title: "Happy Hijinks S9 E2", previewImage: previewImage)
contentProposal.url = urlForHappyHijinksS9E2

// Now assign the proposal to the player item which should show the proposal
playerItemForHappyHijinksS9E1.nextContentProposal = contentProposal
```

Content Proposals

Suggesting what to watch next

NEW

```
public protocol AVContentProposalDelegate {

    optional public func playerViewController(playerViewController: AVPlayerViewController,
        shouldPresent proposal: AVContentProposal) -> Bool

    optional public func playerViewController(playerViewController: AVPlayerViewController,
        didAccept proposal: AVContentProposal)

    optional public func playerViewController(playerViewController: AVPlayerViewController,
        didReject proposal: AVContentProposal)
}
```

Content Proposals

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}
```

Content Proposals

Custom presentations

NEW

```
public class AVContentProposalViewController : UIViewController {
   public var contentProposal: AVContentProposal? { get }
   weak public var playerViewController: AVPlayerViewController? { get }
   public var preferredPlayerViewFrame: CGRect { get }
   public var playerLayoutGuide: UILayoutGuide { get }
   public var dateOfAutomaticAcceptance: Date?
   public func dismissContentProposal(for action: AVContentProposalAction, animated: Bool,
      completion block: (() -> Void)? = nil)
}
```

Content Proposals

Custom presentations

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public class AVContentProposalViewController : UIViewController {
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Content Proposals

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        completion block: (() -> Void)? = nil)
}
```

Content Proposals

Responding to delegate notifications

NEW

```
func playerViewController(playerViewController: AVPlayerViewController,
    shouldPresent proposal: AVContentProposal) -> Bool {

    // Set up a custom presentation just-in-time
    playerViewController.contentProposalViewController =
        MyContentProposalViewController()
    return true
}
```

Content Proposals

Responding to delegate notifications

NEW

```
func playerViewController(playerViewController: AVPlayerViewController,
    didAccept proposal: AVContentProposal) {
    // Replace the current AVPlayerItem with the proposed content
    guard let player = playerViewController.player, let url = proposal.url
        else { return }
    player.replaceCurrentItem(AVPlayerItem(url: url))
}
```

Demo

Content Proposals

Jonathan Long AVKit Engineer

Best Practices
with AVKit on tvOS

Best Practices

With AVKit on tvOS

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With AVKit on tvOS

Let `present` handle zooming from inline player views

Best Practices

With AVKit on tvOS

Let `present` handle zooming from inline player views

Playback is only interactive when full-screen

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Use the new content proposal API

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With AVKit on tvOS

Let `present` handle zooming from inline player views

Playback is only interactive when full-screen

Use the new content proposal API

Observe the player/player item `error` property

Best Practices

With AVKit on tvOS

Avoid toggling `showsPlaybackControls`

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Avoid toggling `showsPlaybackControls`

Avoid adding supplemental gestures to playback

Best Practices

With AVKit on tvOS

Avoid toggling `showsPlaybackControls`

Avoid adding supplemental gestures to playback

Do not overload the Select button or touch surface gestures

Best Practices

With AVKit on tvOS

Replace your asset upon `AVErrorMediaServicesWereReset`

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With AVKit on tvOS

Replace your asset upon `AVErrorMediaServicesWereReset`

Other sessions with best practices for playback:

Advances in AVFoundation Playback	Mission	Wednesday 9:00AM
Mastering Modern Media Playback		WWDC 2014

Summary

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Standard playback controls and behaviors

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Support for remotes, game controllers, and Siri

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Full access to media stack

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Standard playback controls and behaviors

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Full access to media stack

Powerful new APIs

Easy to get started

More Information

https://developer.apple.com/wwdc16/506

Related Sessions

Advances in AVFoundation Playback	Mission	Wednesday 9:00AM
What's New in HTTP Live Streaming	Mission	Wednesday 3:00PM
Developing tvOS Apps Using TVMLKit: Part 1	Mission	Wednesday 1:40PM
Developing tvOS Apps Using TVMLKit: Part 2	Nob Hill	Thursday 4:00PM
Mastering Modern Media Playback		WWDC 2014

Lab

AVKit Lab	Graphics, Games, and Media Lab C	Friday 1:00PM

WWDC16