AVContentKeySession Best Practices

Session 507

Anil Katti, AVFoundation Engineer
Agenda
Agenda

FairPlay Streaming overview
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FairPlay Streaming overview

AVContentKeySession API
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FairPlay Streaming overview
AVContentKeySession API
Common pitfalls around key delivery
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FairPlay Streaming overview
AVContentKeySession API
Common pitfalls around key delivery
Frequently asked questions
FairPlay Streaming Overview
FairPlay Streaming Overview

Introduced in 2015

Protects HLS streams
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Protects HLS streams

Specifies steps to securely deliver content decryption keys
FairPlay Streaming Overview
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Application
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Application

Apple Platform

FPS Key Server Module
FairPlay Streaming Overview

Application

AVFoundation Delegate

AVFoundation

Apple Platform

FPS Key Server Module
FairPlay Streaming Overview

Application
AVFoundation Delegate

Load
Key

AVFoundation
Apple Platform

FPS
Key Server Module
SPC = Secure Playback Context (Encrypted Key Request)
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FairPlay Streaming Overview

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CKC = Content Key Context (Encrypted Key Response)
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AVContentKeySession
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Introduced in 2017
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Designed around content decryption keys
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• Simplified key loading process
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• Simplified key loading process
• Home for new content protection features
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Great adoption - helps optimize key delivery
AVAssetResourceLoader

Application

AVAssetResourceLoaderDelegate

AVAssetResourceLoader

Apple Platform
AVAssetResourceLoader

Application

AVAssetResourceLoaderDelegate

Load

Key

Key

AVAssetResourceLoader

Apple Platform
AVAssetResourceLoader
AVContentKeySession

Application

AVContentKeySessionDelegate

AVContentKeySession

Apple Platform
AVContentKeySession

Application

AVContentKeySessionDelegate

Initiate Key Loading → Load Key → Key

AVContentKeySession

Apple Platform
How Do I Reduce Playback Startup Delay?
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Preload keys that you predict might be used
How Do I Reduce Playback Startup Delay?

Preload keys that you predict might be used

Batch up key requests - reduce round-trips to key server
Preload keys that you predict might be used

Batch up key requests - reduce round-trips to key server

```swift
//Initiate Key Loading Process
contentKeySession.processContentKeyRequest(withIdentifier: "skd://myKey", initializationData: nil, options: nil)

//Delegate Callback
func contentKeySession(_ session: AVContentKeySession, didProvide keyRequest: AVContentKeyRequest)
```
How Do I Reduce Playback Startup Delay?

Preload keys that you predict might be used

Batch up key requests - reduce round-trips to key server

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Could A Key Be Requested Again?
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Yes
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Yes

New keys might be required for decryption (AirPlay, Lightning Digital AV Adapter)
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Yes

New keys might be required for decryption (AirPlay, Lightning Digital AV Adapter)

Always be prepared to answer redundant key requests
How Do I Preload All Keys?
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Need key identifier to load key
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Obtain all key identifiers out-of-band
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Need key identifier to load key

Obtain all key identifiers out-of-band

Advertise session keys (EXT-X-SESSION-KEY) in master m3u8

- Initiate preloading `urlAsset.resourceLoader.preloadsEligibleContentKeys = true`
How Do I Preload All Keys?

Need key identifier to load key

Obtain all key identifiers out-of-band

Advertise session keys (EXT-X-SESSION-KEYs) in master m3u8

- Initiate preloading: `urlAsset.resourceLoader.preloadsEligibleContentKeys = true`
How Can My Live Streams Avoid The Thundering Herd?
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Disperse key request events
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Clients rotate keys at the same time -> impulse load on key server
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Load keys before EXT-X-KEY tag appears
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Scale live offering by load balancing key loading requests
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What Is Offline Rentals?
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Define two expiration durations on offline FairPlay Streaming keys.
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Define two expiration durations on offline FairPlay Streaming keys
• Storage duration

Expires in 30 days
What Is Offline Rentals?

Define two expiration durations on offline FairPlay Streaming keys
• Storage duration
• Playback duration

Expires in 24 hours

Persistent Key

Persistent Key
Define two expiration durations on offline FairPlay Streaming keys

- Storage duration
- Playback duration

Expiration durations are enforced even when the device is offline

What Is Offline Rentals?

Expires in 24 hours
How Do I Do Offline Rentals?
How Do I Do Offline Rentals?

Use Offline Key TLLV

<table>
<thead>
<tr>
<th>Table 7-1  Offline Key TLLV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field name</td>
</tr>
<tr>
<td>TLLV tag</td>
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How Do I Do Offline Rentals?

Use Offline Key TLLV

• Signaled in CKC used while requesting persistent key

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How Do I Do Offline Rentals?
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```swift
//Requesting persistent key from AVPersistableContentKeyRequest
let persistentKey = try persistableKeyRequest.persistableContentKey(fromKeyVendorResponse:
ckcData, options: nil)
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How Do I Do Offline Rentals?

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Expires in 30 days

Persistent Key

Persistent Key
How Do I Do Offline Rentals?

Expires in 30 days

Persistent Key

Persistent Key
How Do I Do Offline Rentals?

```swift
//Delegate Callback
func contentKeySession(_ session: AVContentKeySession,
    didUpdatePersistableContentKey persistableContentKey: Data,
    forContentKeyIdentifier keyIdentifier: Any)
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Expires in 30 days

Updated Persistent Key

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Expires in 24 hours
How Do I Handle Errors While Loading Keys?
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When something fails...
How Do I Handle Errors While Loading Keys?

When something fails...

• Report error to AVFoundation

//Setting error on an AVContentKeyRequest
contentKeyRequest.processContentKeyResponseError(error)

//Setting error on an AVAssetResourceLoadingRequest
resourceLoadingRequest.finishLoading(with: error)
How Do I Handle Errors While Loading Keys?

When something fails...

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• Monitor error logs and address root-cause
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Common Pitfalls While Delivering Keys
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Taking too long to provide key response
• Player times out waiting for key response
Common Pitfalls While Delivering Keys

Taking too long to provide key response
• Player times out waiting for key response
• Deliver keys as soon as possible
Common Pitfalls While Delivering Keys

Taking too long to provide key response
• Player times out waiting for key response
• Deliver keys as soon as possible
• Survey `playerItem.accessLogs()`
Common Pitfalls While Delivering Keys
Common Pitfalls While Delivering Keys

Using same keys across variants with different HDCP requirements
  • HDCP requirement is signaled inside key response
Common Pitfalls While Delivering Keys

Using same keys across variants with different HDCP requirements
• HDCP requirement is signaled inside key response
• Use multiple key identifiers
Common Pitfalls While Delivering Keys
Common Pitfalls While Delivering Keys

Using persistent keys to answer all key loading requests

- Persistent keys cannot be shared across devices (AirPlay)
Common Pitfalls While Delivering Keys

Using persistent keys to answer all key loading requests
• Persistent keys cannot be shared across devices (AirPlay)
• Make sure key loading request accepts persistent keys
Common Pitfalls While Delivering Keys

Using persistent keys to answer all key loading requests

• Persistent keys cannot be shared across devices (AirPlay)
• Make sure key loading request accepts persistent keys
• Minor API changes in iOS 11.2+
Is Persistent Key Accepted As Response?
Is Persistent Key Accepted As Response?

Using AVContentKeySession

do {
    try contentKeyRequest.respondByRequestingPersistableContentKeyRequestAndReturnError()
} catch {
    //Fallback to provide online FairPlay Streaming key from key server
}
Is Persistent Key Accepted As Response?
Is Persistent Key Accepted As Response?

Using AVAssetResourceLoader

```swift
if let contentTypes = resourceLoadingRequest.contentInformationRequest?.allowedContentTypes,
   !contentTypes.contains(AVStreamingKeyDeliveryPersistentContentKeyType) {
   // Fallback to provide online FairPlay Streaming key from key server
}
```
Summary
Summary

AVContentKeySession API
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AVContentKeySession API

How to improve playback startup?
Summary

AVContentKeySession API

How to improve playback startup?

How to scale live streaming?
Summary

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How to avoid common pitfalls while delivering keys?
More Information

https://developer.apple.com/wwdc18/507