Introducing HEIF and HEVC

Session 503

Gavin Thomson, Photos Manager
Athar Shah, CoreMedia Manager
It’s happening!
Media today

HEVC

HEIF

Ecosystem adoption and best practices
Media today

HEVC

HEIF

Ecosystem adoption and best practices
Today’s Environment
Today’s Environment

Proliferation of movie and image assets (capture, cloud storage, sharing, etc.)
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Higher resolution and frame rate content (4K and beyond)
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H.264 and JPEG are limiting
Media today

HEVC

HEIF

Ecosystem adoption and best practices
HEVC (High Efficiency Video Coding)

Standardized and approved by ITU-T in 2013
- ISO/IEC: MPEG-H Part 2
- ITU-T: H.265

Follow on to H.264

Delivers significant compression improvement over H.264

Adopted in the industry
HEVC Coding Improvements
HEVC Coding Improvements

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Up to 40%

Better compression than H.264 in general use case
Up to 2x

Better compression than H.264 in iOS camera capture
Apple HEVC Support
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Apple HEVC Support
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<td>QuickTime Movie (.mov), ISO MPEG-4 (.mp4)</td>
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</table>
Benefits of HEVC

Industry and Apple support

Works with industry file formats

Ideal codec for movie and photo compression
Media today
HEVC
HEIF
Ecosystem adoption and best practices
Key Requirements for New Image File Format
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Compression codec support (HEVC in particular)
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Alpha channel and depth support
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Partitioning of image into rectangular tiles
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HEIF (High Efficiency Image File Format)
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ISO standard: ISO/IEC 23008-12 (June 2015)
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Container format based on ISO Base Media File Format
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Supports individual images and sequences
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Flexible format for additional use cases

Typically uses HEVC for compression
Up to 2x
Better compression than JPEG
# HEIF File Extension

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**High Efficiency Image File Format**  WWDC17 Video
Media today
HEVC
HEIF
Ecosystem adoption and best practices
HEIF/HEVC Ecosystem

Creation ←→ Access ←→ Transfer
HEIF/HEVC Ecosystem

Creation → Access → Transfer
HEIF/HEVC Ecosystem

Creation → Access → Transfer
HEIF/HEVC Ecosystem

Creation → Access → Transfer
Apple HEIF
Characteristics of Apple-generated HEIF images

HEIF container

ftyp - File Type
brand : heic

mdat - Media Data
Exif metadata
thumbnail data
HEVC image data
Apple HEIF
Characteristics of Apple-generated HEIF images

ISO base media file format

HEIF container

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HEVC coded images

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ISO base media file format

HEVC coded images

Encoded as tiles
Apple HEIF
Characteristics of Apple-generated HEIF images

ISO base media file format

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320 x 240 embedded thumbnail
Apple HEIF
Characteristics of Apple-generated HEIF images

ISO base media file format
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Exif image metadata
"heic" file extension
HEIF Image Decode Support

Minimum configurations

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HEIF image support
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ImageIO—supported image source
Accessing HEIF
HEIF image support

ImageIO—supported image source

Core Image—supported image source
Accessing HEIF

HEIF image support

- ImageIO—supported image source
- Core Image—supported image source
- PhotoKit—image, resources, and edit
Accessing HEIF
HEIF image support

ImageIO—supported image source
Core Image—supported image source
PhotoKit—image, resources, and edit
Apple applications
Apple HEVC
Characteristics of Apple-captured HEVC movie

QuickTime container

ftyp - File Type
brand: qt

mdat - Media Data
HEVC coded frames
Apple HEVC
Characteristics of Apple-captured HEVC movie

QuickTime movie file format

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ftyp - File Type
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Apple HEVC

Characteristics of Apple-captured HEVC movie

QuickTime movie file format

HEVC coded video frames
Apple HEVC
Characteristics of Apple-captured HEVC movie

QuickTime movie file format

HEVC coded video frames

8- and 10-bit encoding
Apple HEVC
Characteristics of Apple-captured HEVC movie

QuickTime movie file format
HEVC coded video frames
8- and 10-bit encoding
“mov” file extension
## HEVC Movie Decode Support

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HEVC movie support
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HEVC movie support

AVFoundation—supported media source
Accessing HEVC
HEVC movie support

AVFoundation—supported media source

PhotoKit—movies, resources, and edit
Accessing HEVC
HEVC movie support

AVFoundation—supported media source

PhotoKit—movies, resources, and edit

WebKit—hardware support and macOS desktops
Accessing HEVC
HEVC movie support

AVFoundation—supported media source

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HTTP Live Streaming
Accessing HEVC
HEVC movie support

AVFoundation—supported media source

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HTTP Live Streaming

Apple apps
Accessing HEVC
Decodable vs. playable
Accessing HEVC
Decodable vs. playable

No hardware acceleration on some older devices
Accessing HEVC
Decodable vs. playable

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All movie formats are decodable
Accessing HEVC
Decodable vs. playable

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Apple captured 4K30 playing in software
Accessing Photo APIs
HEIF/HEVC support through Photo APIs
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HEIF/HEVC support through Photo APIs

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Transparent for on-device workflows
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ImageIO
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Transparent for on-device workflows

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AVFoundation

Core Image
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Transparent for on-device workflows

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UIKit
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PhotoKit
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Transparent for on-device workflows

ImageIO
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UIKit
PhotoKit
HEIF/HEVC Ecosystem

Creation → Access → Transfer
# HEIF Image Encode Support

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Creating HEIF
How HEIF Images are created
Creating HEIF
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ImageIO—supported image destination
Creating HEIF
How HEIF Images are created

ImageIO—supported image destination

AVFoundation—photo capture output
Creating HEIF
How HEIF Images are created

ImageIO—supported image destination
AVFoundation—photo capture output
Camera
Creating HEIF
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Only heic
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How HEVC movies are created
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AVFoundation—export destination
Creating HEVC
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AVFoundation—export destination

AVFoundation—video capture session
Creating HEVC
How HEVC movies are created

AVFoundation—export destination

AVFoundation—video capture session

Camera
HEIF/HEVC Ecosystem

Creation → Access → Transfer
HEIF/HEVC Ecosystem

Creation → Access → Transfer
Transferring HEIF/HEVC
Strategies for moving HEIF/HEVC media off the creation device
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Strategies for moving HEIF/HEVC media off the creation device

The options to consider
Transferring HEIF/HEVC

Strategies for moving HEIF/HEVC media off the creation device

The options to consider

• Always transcode
Transferring HEIF/HEVC
Strategies for moving HEIF/HEVC media off the creation device

The options to consider

• Always transcode
• Capabilities exchange
Transferring HEIF/HEVC
Strategies for moving HEIF/HEVC media off the creation device

The options to consider

• Always transcode
• Capabilities exchange
Transferring and Always Transcoding

Social network client example

- Social Network Client
  - HEIF Image Server
- Server
- Supported Receiver
- Unsupported Receiver
Transferring and Always Transcoding
Social network client example

Can’t evaluate capabilities of all receiving devices

Social Network Client
HEIF Image

Server

Supported Receiver

Unsupported Receiver
Transferring and Always Transcoding
Social network client example

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Social Network Client
HEIF Image

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Can’t evaluate capabilities of all receiving devices

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Social Network Client
HEIF Image

Supported Receiver

JPG

Unsupported Receiver

JPG

Server
Transferring HEIF/HEVC
Strategies for moving HEIF/HEVC media off the creation device

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Strategies for moving HEIF/HEVC media off the creation device

The options to consider

• Always transcode
• Capabilities exchange
Transferring with Capabilities
Multipeer Connectivity (P2P) example

Sender
HEIF Image

Receiver
Transferring with Capabilities
Multipeer Connectivity (P2P) example

Receiver sends capabilities
Transferring with Capabilities
Multipeer Connectivity (P2P) example

Receiver sends capabilities

Sender evaluates capabilities to determine transcode policy

Sender
HEIF Image

Capabilities
HEIF or JPG

Receiver
Transferring HEIF/HEVC
Apple transfer workflows
# Transferring HEIF/HEVC

## Apple transfer workflows

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## Transferring HEIF/HEVC

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HEVC is Apple’s next generation codec
Summary

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Adopting HEIF as an image file format
Summary

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Adopting HEIF as an image file format

Transparent within the Apple ecosystem
Summary

HEVC is Apple’s next generation codec

Adopting HEIF as an image file format

Transparent within the Apple ecosystem

Developers should produce their own HEIF/HEVC content
More Information

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<td>Technology Lab A</td>
<td>Wed 9:00AM–11:00AM</td>
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<tr>
<td>AVFoundation Lab</td>
<td>Technology Lab G</td>
<td>Wed 11:00AM–1:00PM</td>
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<td>AVFoundation Lab</td>
<td>Technology Lab F</td>
<td>Thur 12:00PM–3:00PM</td>
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