Building Document Based Apps
Session 234

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What’s a Document Based App?

General characteristics
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General characteristics

Document is a single standalone entity
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General characteristics

Document is a single standalone entity
Document based app manages a list of documents
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Document based app manages a list of documents
Presents to user to edit etc
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Presents to user to edit etc
Building a Document Browser
Document Browser
Components
Document Browser
Components

List documents in a meaningful way
Document Browser

Components

List documents in a meaningful way
Use thumbnails for document visibility
Document Browser

Components

List documents in a meaningful way
Use thumbnails for document visibility
Show external documents
Document Browser

Components

List documents in a meaningful way
Use thumbnails for document visibility
Show external documents
Store recently accessed documents
Discovering Documents
NSFileManager results are incomplete
Document Browser

Discovering documents

NSFileManager results are incomplete

- iCloud content isn’t always available locally
Document Browser

Discovering documents

NSFileManager results are incomplete

- iCloud content isn’t always available locally
- External documents not included
Document Browser

Discovering documents

Your App’s Container

Doc 1

Doc 2

Doc 3

Other App’s Container

Doc 4

Doc 5
Document Browser
Discovering documents

NSURL 1
NSURL 2

Your App’s Container
Doc 1 → Doc 2
Doc 3

Other App’s Container
Doc 4 → Doc 5

NSFileManager APIs
Document Browser
Discovering documents

 NSURL 1
 NSURL 2

 Your App’s Container
 Doc 1 → Doc 2
 Doc 3

 Other App’s Container
 Doc 4 → Doc 5

 NSFFileManager APIs
Document Browser
Discover documents with NSMetadataQuery
Document Browser

Discover documents with NSMetadataQuery

NSMetadataItem 1
NSMetadataItem 2
NSMetadataItem 3
NSMetadataItem 4

Your App’s Container
Doc 1
Doc 2
Doc 3

NSMetadataQuery APIs

Other App’s Container
Doc 4
Doc 5
Document Browser
Discover documents with NSMetadataQuery

NSMetadataQuery APIs

Document Browser
NSMetadataQuery APIs

Your App’s Container
NSMetadataQuery API

Other App’s Container
NSMetadataQuery API

Deck 1
Deck 2
Deck 3
Deck 4
Deck 5
Document Browser
NSMetadataQuery

Your App’s Container
Doc 1
Doc 2
Doc 3

Other App’s Container
Doc 4
Doc 5
Document Browser

NSMetadataQuery

Create NSMetadataQuery

Your App’s Container

Doc 1
Doc 3
Doc 2

Other App’s Container

Doc 4
Doc 5
Document Browser
NSMetadataQuery

List Initial Documents

Your App's Container
NSMetadataItem 1
NSMetadataItem 2
NSMetadataItem 3
NSMetadataItem 4

Other App's Container
Doc 1
Doc 2
Doc 3
Doc 4
Doc 5
Document Browser
NSMetadataQuery

Update Notifications

Your App’s Container

NSMetadataItem 1
NSMetadataItem 2
NSMetadataItem 3
NSMetadataItem 4
NSMetadataItem 6

Other App’s Container

Doc 1
Doc 2
Doc 3
Doc 4
Doc 5
Doc 6
Document Browser

NSMetadataQuery

NSMetadataItem 1
NSMetadataItem 2
NSMetadataItem 3
NSMetadataItem 4
NSMetadataItem 6

Your App’s Container
Doc 1 → Doc 2
Doc 3
Doc 4 – Doc 6

Other App’s Container
Doc 4 → Doc 5

Compute Animations
Document Browser

Thumbnails
Document Browser

Thumbnails

Gives visual context to users
Document Browser

Thumbnails

Gives visual context to users
Generated automatically for certain documents
Document Browser
Loading thumbnails for display

Main Queue

Background Queue
Document Browser

Loading thumbnails for display

Main Queue

Background Queue
Document Browser

Loading thumbnails for display

Main Queue

Load Cell

Background Queue

Fetch Thumbnail
Document Browser

Loading thumbnails for display

Main Queue
- Load Cell
- Display Cell With Placeholder

Background Queue
- Fetch Thumbnail
Document Browser
Loading thumbnails for display

Main Queue
- Load Cell
- Display Cell With Placeholder
- Reload Cell

Background Queue
- Fetch Thumbnail
Document Browser

Loading thumbnails for display

Main Queue
- Load Cell
- Display Cell With Placeholder
- Reload Cell
- Display Cell With Thumbnail

Background Queue
- Fetch Thumbnail
Managing a Recents List
Recents List

Storing recently-used items list
Recents List
Storing recently-used items list

Give easy access to recently used documents
Recents List

Storing recently-used items list

Give easy access to recently used documents

Storing NSURLs isn’t robust
Recents List
Storing recently-used items list

 NSURL

Your App's Container

Doc 1
Recents List
Storing recently-used items list

NSURL

Your App’s Container

Doc 1
Recents List
Storing recently-used items list
Recents List
Use security scoped bookmarks
Recents List

Use security scoped bookmarks

[Diagram showing a bookmark connected to a container labeled "Your App's Container" and a document labeled "Doc 1"]
Recents List

Use security scoped bookmarks
Demo
Discover documents using NSMetadataQuery
Document Browser Summary

Discover documents using NSMetadataQuery
Display thumbnails
Document Browser Summary

Discover documents using NSMetadataQuery
Display thumbnails
Store recent list using bookmarks
Document Access

File coordination and presentation
Document Access

File coordination and presentation

Multiple applications can read or write documents
Document Access

File coordination and presentation

Multiple applications can read or write documents

• Your app, other apps, iCloud Drive…
Document Access

File coordination and presentation
Document Access

File coordination and presentation

Your App

Write
Document Access

File coordination and presentation

Your App

Write

Write
Document Access

File coordination and presentation

Your App

- Write
- Write

Other App
Document Access

File coordination and presentation

Your App: Write Write
Other App: Read
Document Access

File coordination and presentation

Your App:
- Write
- Write

Other App:
- Inconsistent Read
Document Access

File coordination and presentation

Your App
- Write
- Inconsistent Read

Other App
- Write
- Stale Display
Document Access

File coordination and presentation

Your App
- Write
- Write

Other App
- Inconsistent Read
- Stale Display
Document Access

File coordination and presentation

NSFileCoordination: Reader/writer lock

Your App

- Write

Other App

- Inconsistent Read
- Stale Display

Write

Inconsistent Read

Stale Display
Document Access

File coordination and presentation

NSFileCoordination: Reader/writer lock

Your App

Other App

Write

Coordinated Read

Write

Stale Display
Document Access

File coordination and presentation

NSFileCoordination: Reader/writer lock
NSFilePresenter: Notification mechanism

Your App

| Write | Coordinated Read | Write |

Other App

Stale Display
Document Access

File coordination and presentation

NSFileCoordination: Reader/writer lock
NSFilePresenter: Notification mechanism

Your App
- Write

Other App
- Coordinated Read
  - Update
- Write
Document Management

Creating new documents
Document Management

Creating new documents

Goals
Document Management

Creating new documents

Goals

• Consistent
Document Management

Creating new documents

Goals

• Consistent
• Up-to-date
Document Management
Creating new documents

Goals
• Consistent
• Up-to-date

Your App
Document Management
Creating new documents

Goals
• Consistent
• Up-to-date

Your App
Document Creation
Document Management

Creating new documents

Goals

• Consistent
• Up-to-date

Your App

- Document Creation
- Display in UI
Document Management

Creating new documents

Goals

• Consistent
• Up-to-date

Your App

- Document Creation
- Display in UI
Document Management
Creating new documents

Coordinated operations update directly!

Your App

- Document Creation
- Display in UI
Document Management
Creating new documents

Coordinated operations update directly!

Your App
- Document Creation
- Display in UI
Document Management

Creating new documents

Main thread

Document Creation
Document Management

Creating new documents

Main thread

- Document Creation
- Main Thread Blocked
Document Management
Creating new documents

Coordinated operations can block

- Main thread
- Document Creation
- Main Thread Blocked
Document Management

Creating new documents

Coordinated operations can block

Use background queue

Main thread
- Document Creation
- Main Thread Blocked

Background queue
Coordinated operations can block
Use background queue

Document Management
Creating new documents

Main thread
User action

Background queue
Document Creation
Coordinated operations can block
Use background queue

Creating new documents

Document Management
Coordinated operations can block
Use background queue
Deletion same

Document Management
Creating new documents

User action
Document Creation
Display in UI

Main thread
Background queue
Loading and Displaying

Reading documents

UIDocument for reading and writing
Loading and Displaying

Reading documents

UIDocument for reading and writing

Main thread

open

Background queue
Loading and Displaying

Reading documents

UIDocument for reading and writing

Main thread
- open

Background queue
- Coordinated Read
Loading and Displaying
Reading documents

UIDocument for reading and writing
Loading and Displaying
Reading documents

UIKitDocument for reading and writing
Loading and Displaying

Reading documents

Main thread
- open
- completion

Background queue
- Coordinated Read
- loadFromContents()
Loading and Displaying
Reading documents

Reading may trigger a download
Loading and Displaying
Reading documents

Reading may trigger a download
NSProgressReporting
Loading and Displaying

Reading documents

Reading may trigger a download

NSProgressReporting
Loading and Displaying

Reading documents

Reading may trigger a download

NSProgressReporting

Main thread
- open
- State Change
- Progress display
- completion

Background queue
- Coordinated Read
- loadFromContents()
Loading and Displaying
Reading documents

Reading may trigger a download
NSProgressReporting
Loading and Displaying
Writing documents

Background queue
Loading and Displaying
Writing documents

Like reading: File coordination, background queue

Background queue
- Coordinated Write
- contentsForType()
Loading and Displaying
Writing documents

Like reading: File coordination, background queue

Thumbnails
Loading and Displaying

Writing documents

Like reading: File coordination, background queue

Thumbnails

Called on a background queue!

- Coordinated Write
- contentsForType()
- fileAttributesToWriteToURL()
Loading and Displaying
Writing documents

Like reading: File coordination, background queue

Thumbnails

Called on a background queue!

• No UIViews!
Opening from Other Apps

iOS 8—Open by copy
Opening from Other Apps

iOS 8—Open by copy

Apps don’t have access to each other’s documents
Opening from Other Apps

iOS 8—Open by copy

Apps don’t have access to each other’s documents

- Opening using the UIDocumentInteractionController causes a copy

Your App’s Container

Other App’s Container
Opening from Other Apps

iOS 8—Open by copy

Apps don’t have access to each other's documents

- Opening using the UIDocumentInteractionController causes a copy
Opening from Other Apps

iOS 8—Open by copy

Apps don’t have access to each others documents

- Opening using the UIDocumentInteractionController causes a copy
- Proliferation of copies
Opening from Other Apps

iOS 9—Open in place
Opening from Other Apps

iOS 9—Open in place

Access to other app’s containers granted by document interaction controller
Opening from Other Apps

iOS 9—Open in place

Access to other app’s containers granted by document interaction controller
Opening from Other Apps

iOS 9—Open in place

Access to other app’s containers granted by document interaction controller
• Includes files opened from the iCloud Drive app and Spotlight
Opening from Other Apps

iOS 9—Open in place

Access to other app’s containers granted by document interaction controller
• Includes files opened from the iCloud Drive app and Spotlight
• UIDocumentMenuViewController, UIDocument

Your App’s Container

Other App’s Container
Opening from Other Apps
Supporting open in place
Opening from Other Apps
Supporting open in place

Support is simple
Opening from Other Apps

Supporting open in place

Support is simple

• LSSupportsOpeningDocumentsInPlace key in Info.plist
Opening from Other Apps

Supporting open in place

Support is simple

• LSSupportsOpeningDocumentsInPlace key in Info.plist
• Adopt new delegate method
Opening from Other Apps
Handling open in place versus copy

```swift
func application(app: UIApplication, openURL url: NSURL, 
sourceApplication: String?, annotation: AnyObject) -> Bool {
    let newURL = copyFileToContainer(url)
    documentBrowser.openDocumentAtURL(newURL)
    return true
}
```
func application(app: UIApplication, openURL url: NSURL, options: [String: AnyObject]) -> Bool {
    let newURL = copyFileToContainer(url)
    documentBrowser.openDocumentAtURL(newURL)
    return true
}
func application(app: UIApplication, openURL url: NSURL, options: [String: AnyObject]) -> Bool {
    guard let shouldOpenInPlace = options[UIApplicationOpenURLOptionsOpenInPlaceKey] as? Bool else {
        return false
    }

    let newURL = copyFileToContainer(url)
    documentBrowser.openDocumentAtURL(newURL)

    return true
}
func application(app: UIApplication, openURL url: NSURL, options: [String: AnyObject]) -> Bool {
    guard let shouldOpenInPlace = options[UIApplicationOpenURLOptionsOpenInPlaceKey] as? Bool else {
        return false
    }

    let newURL = shouldOpenInPlace ? url : copyFileToContainer(url)
    documentBrowser.openDocumentAtURL(newURL)

    return true
}
Opening from Other Apps
Handling open in place versus copy

```swift
func application(app: UIApplication, openURL url: NSURL, options: [String: AnyObject]) -> Bool {
    guard let shouldOpenInPlace = options[UIApplicationOpenURLOptionsOpenInPlaceKey] as? Bool else {
        return false
    }

    let newURL = shouldOpenInPlace ? url : copyFileToContainer(url)
    documentBrowser.openDocumentAtURL(newURL)

    return true
}
```
Summary
Summary

Make your app performant, responsive, and beautiful
Summary

Make your app performant, responsive, and beautiful

- NSMetadataQuery
Summary

Make your app performant, responsive, and beautiful

• NSMetadataQuery
• Bookmarks
Summary

Make your app performant, responsive, and beautiful

• NSMetadataQuery
• Bookmarks
• Progress
Summary

Make your app performant, responsive, and beautiful

• NSMetadataQuery
• Bookmarks
• Progress
• Open-in-place
More Information

Sample Code

Technical Support
Apple Developer Forums
http://developer.apple.com/forums

iCloud Documentation
http://developer.apple.com/icloud
# Related Sessions

<table>
<thead>
<tr>
<th>Building a Document Based App</th>
<th>Session 234</th>
<th>WWDC14</th>
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