System Frameworks

#WWDC17

What's New in Core Spotlight

Search on macOS and iOS

Session 231

John Hörnkvist, Spotlight
Lyn Fong, Spotlight

CoreSpotlight on macOS

CoreSpotlight on macOS

Drag and Drop

CoreSpotlight on macOS

Drag and Drop

Quick Look Previews

CoreSpotlight on macOS

Drag and Drop

Quick Look Previews

Ranking

CoreSpotlight on macOS

Drag and Drop

Quick Look Previews

Ranking

Indexing and Metadata

CoreSpotlight on macOS

Drag and Drop

Quick Look Previews

Ranking

Indexing and Metadata

Search

CoreSpotlight on macOS

NEW

CoreSpotlight on macOS

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Same API as on iOS

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Same API as on iOS

Used by Notes, Safari, and CoreData

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Great for databases, shoeboxes

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Not for “documents”

CoreSpotlight on macOS

NEW

Same API as on iOS

Used by Notes, Safari, and CoreData

Great for databases, shoeboxes

Not for “documents”

No sharing between users

Drag and Drop

NEW

Drag and Drop

NEW

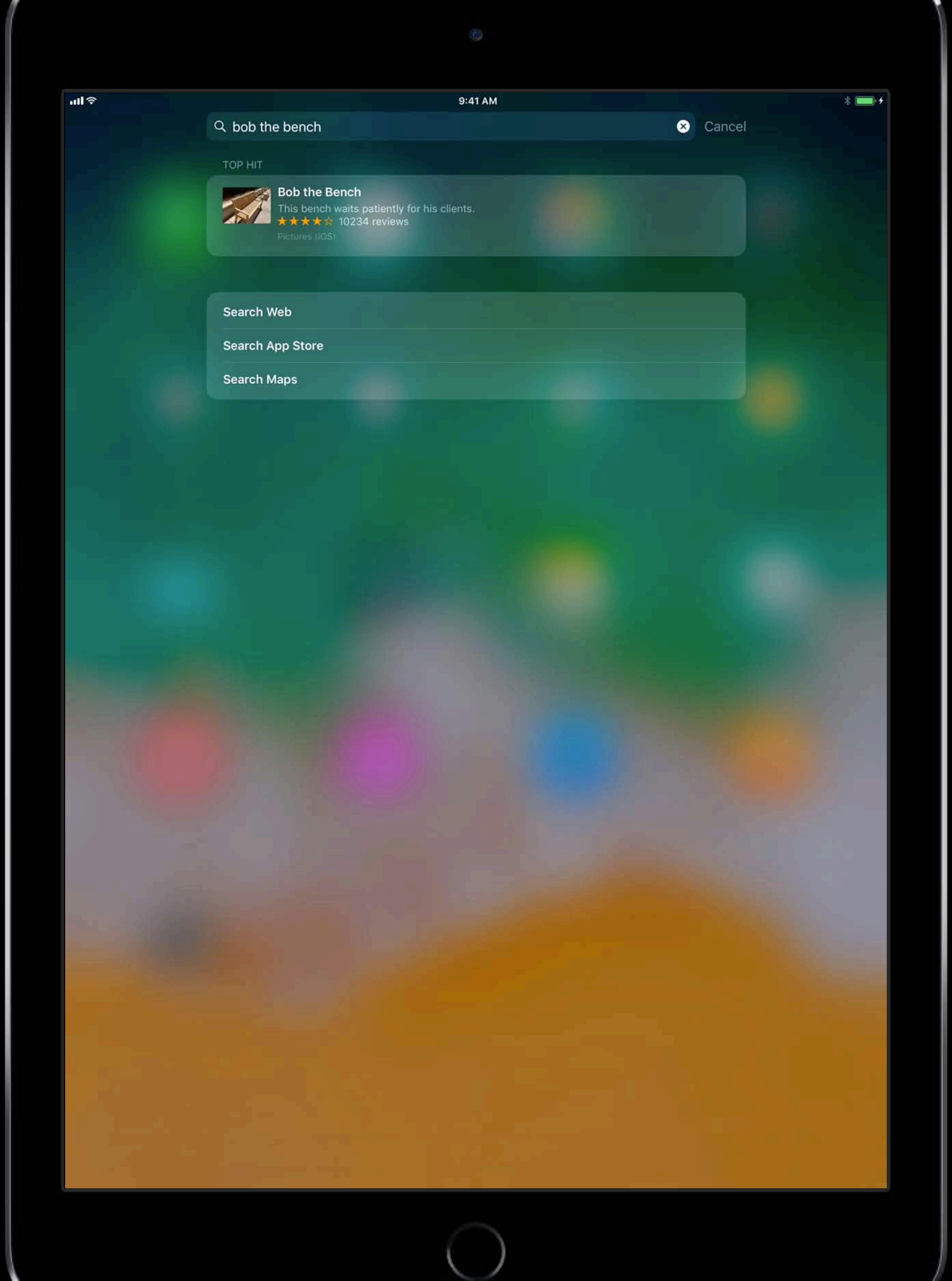
Promise drag types when indexed

Drag and Drop

NEW

Promise drag types when indexed

App extension fulfills the promise


9:41 AM

bob the bench

Cancel

TOP HIT

Bob the Bench

This bench waits patiently for his clients.

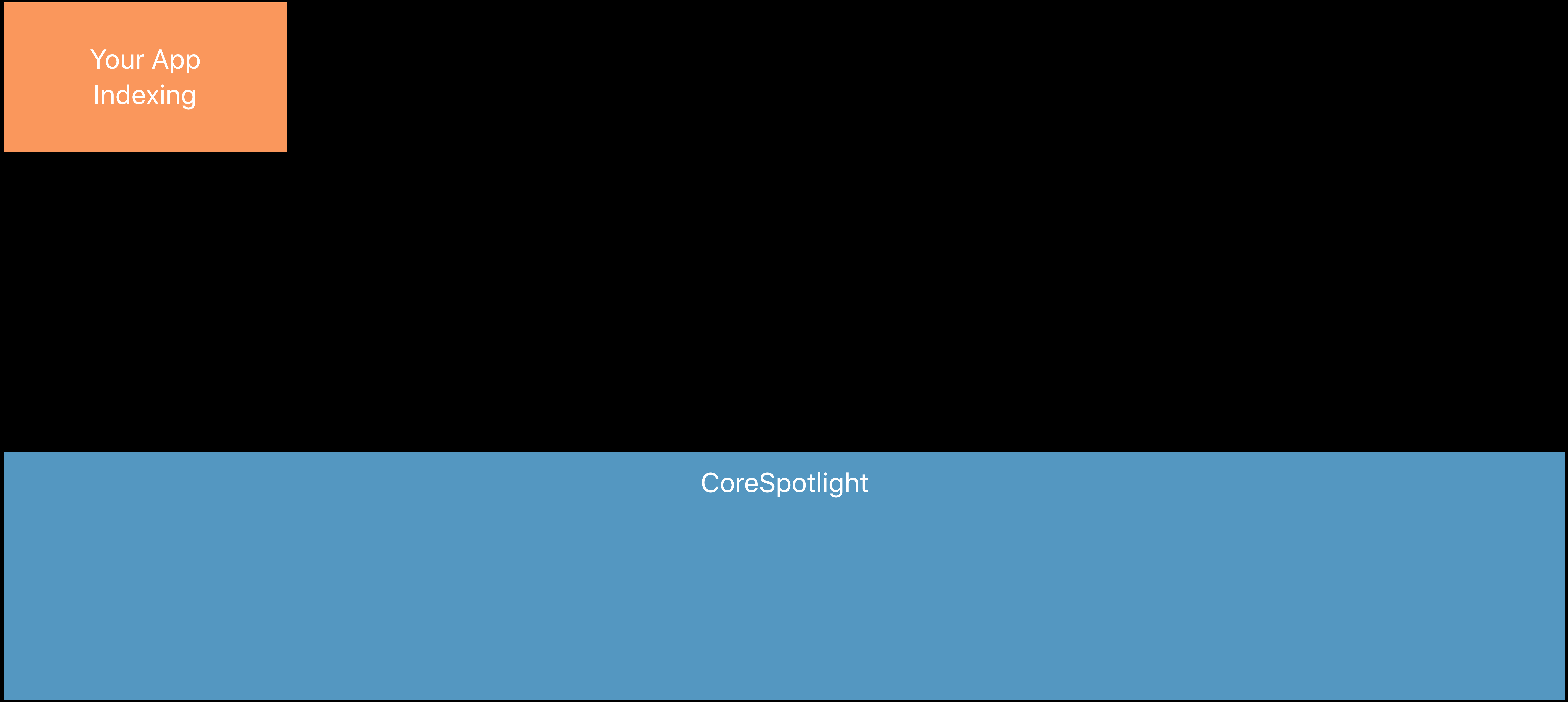
★★★★☆ 10234 reviews

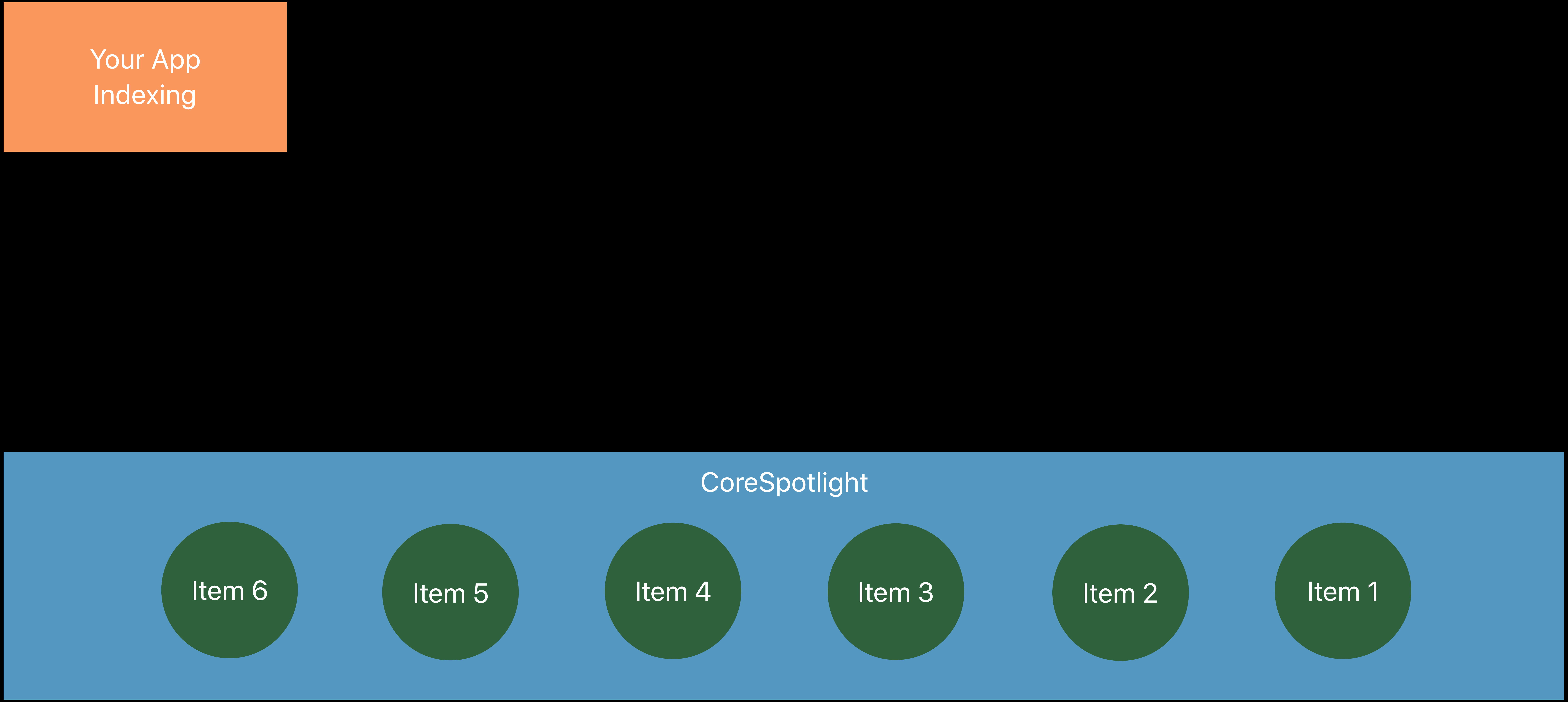
Pictures (iOS)

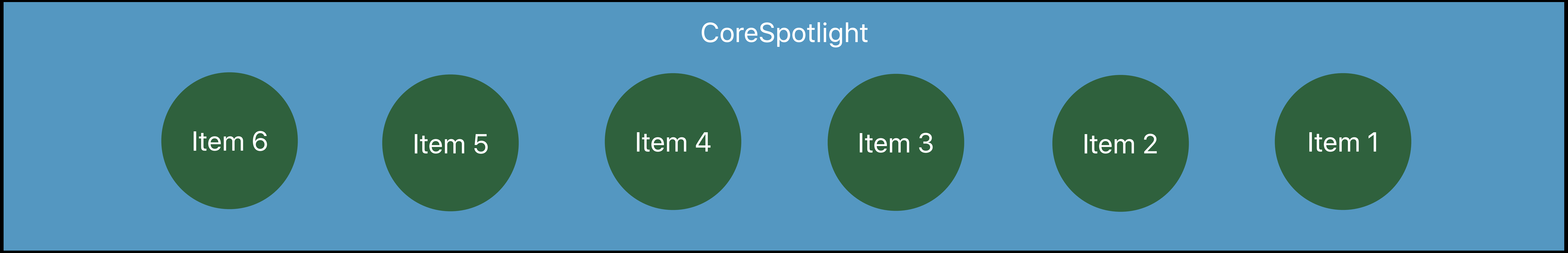
Search Web

Search App Store

Search Maps


Your App
Indexing
CoreSpotlight


Your App
Indexing
CoreSpotlight
Item 6
Item 5
Item 4
Item 3
Item 2
Item 1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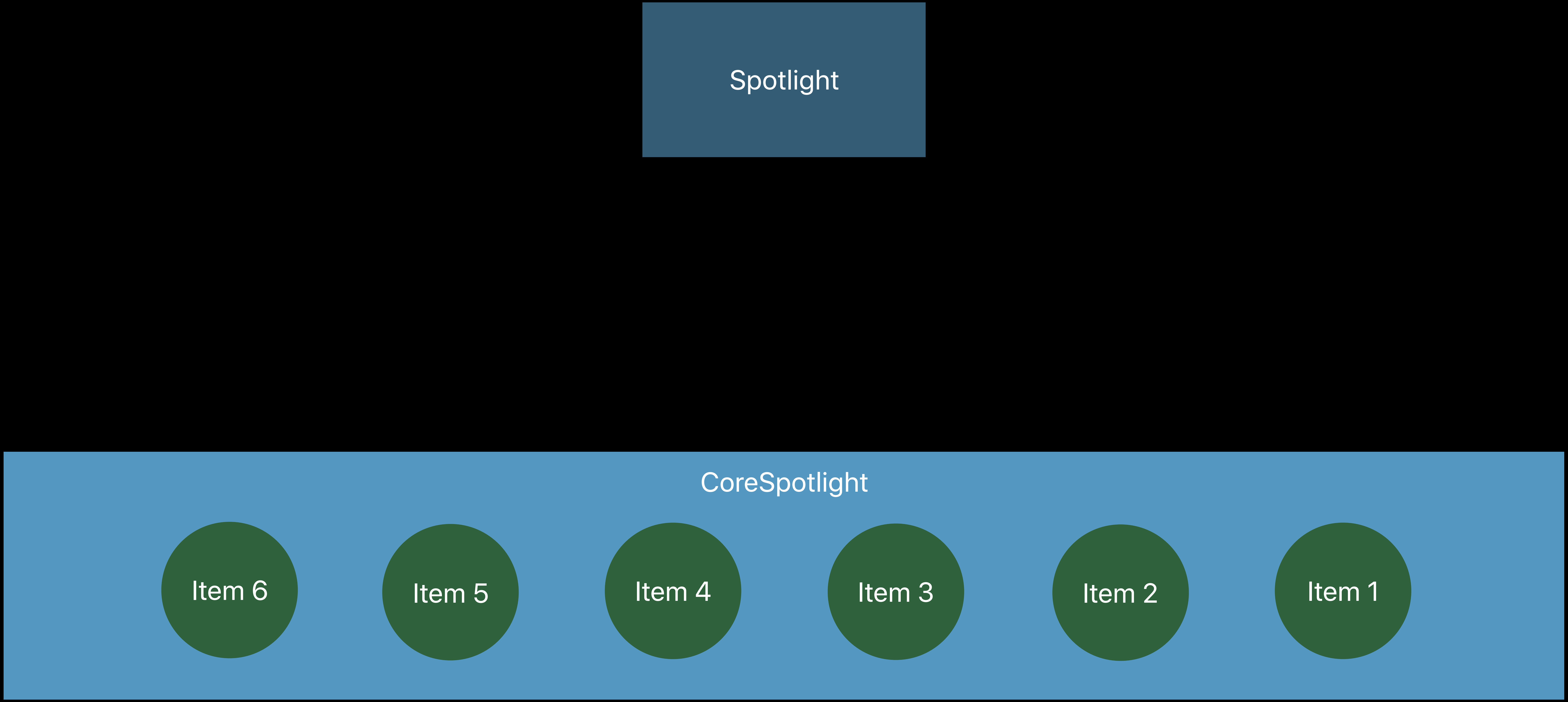
Spotlight
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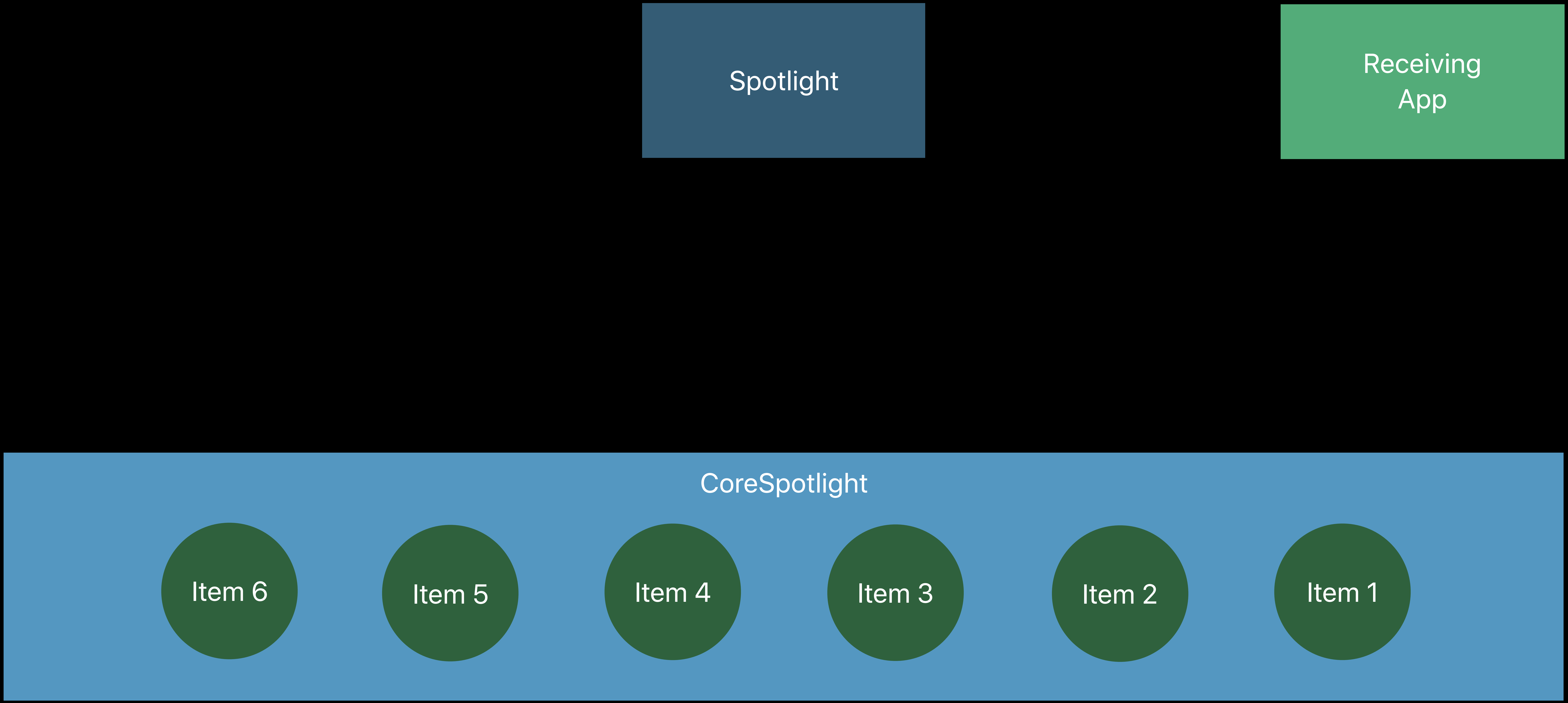
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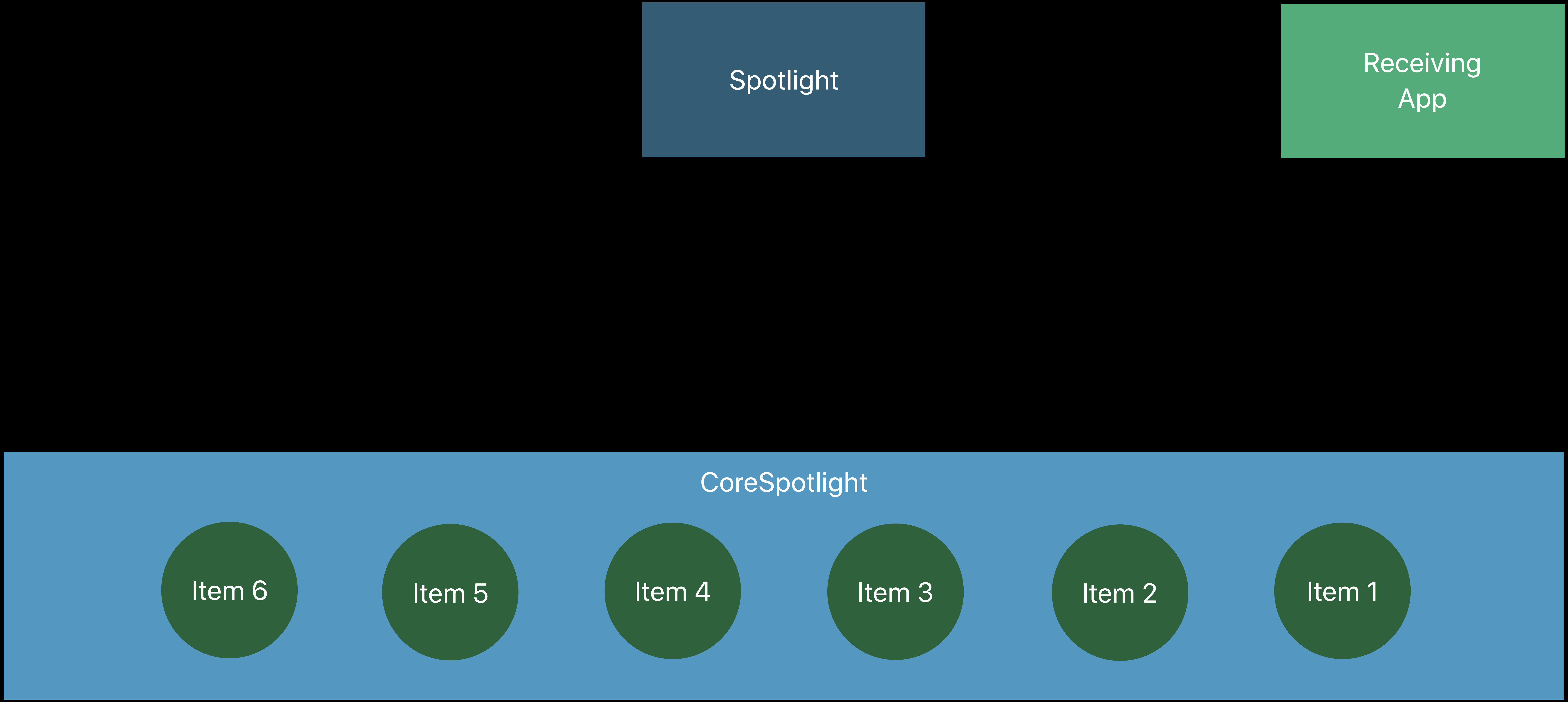
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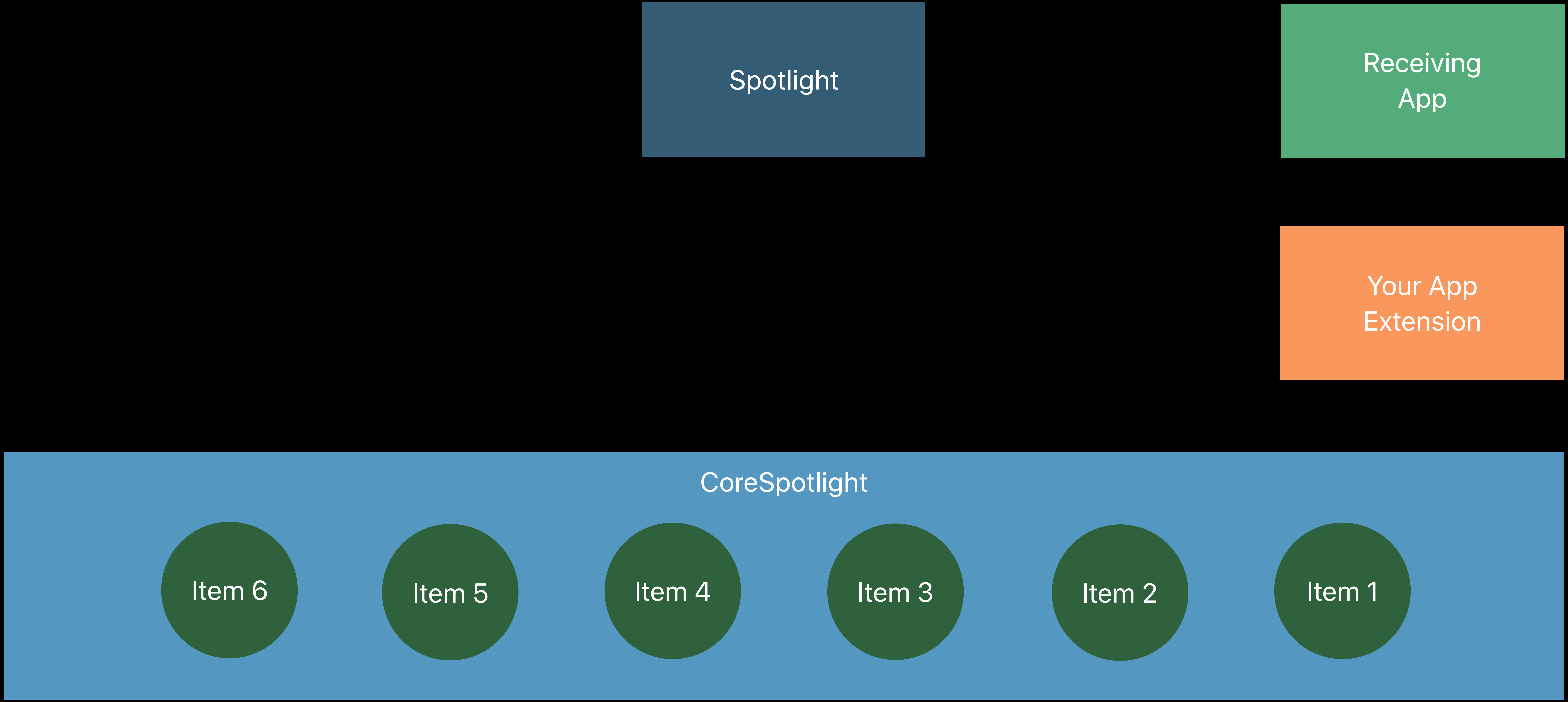
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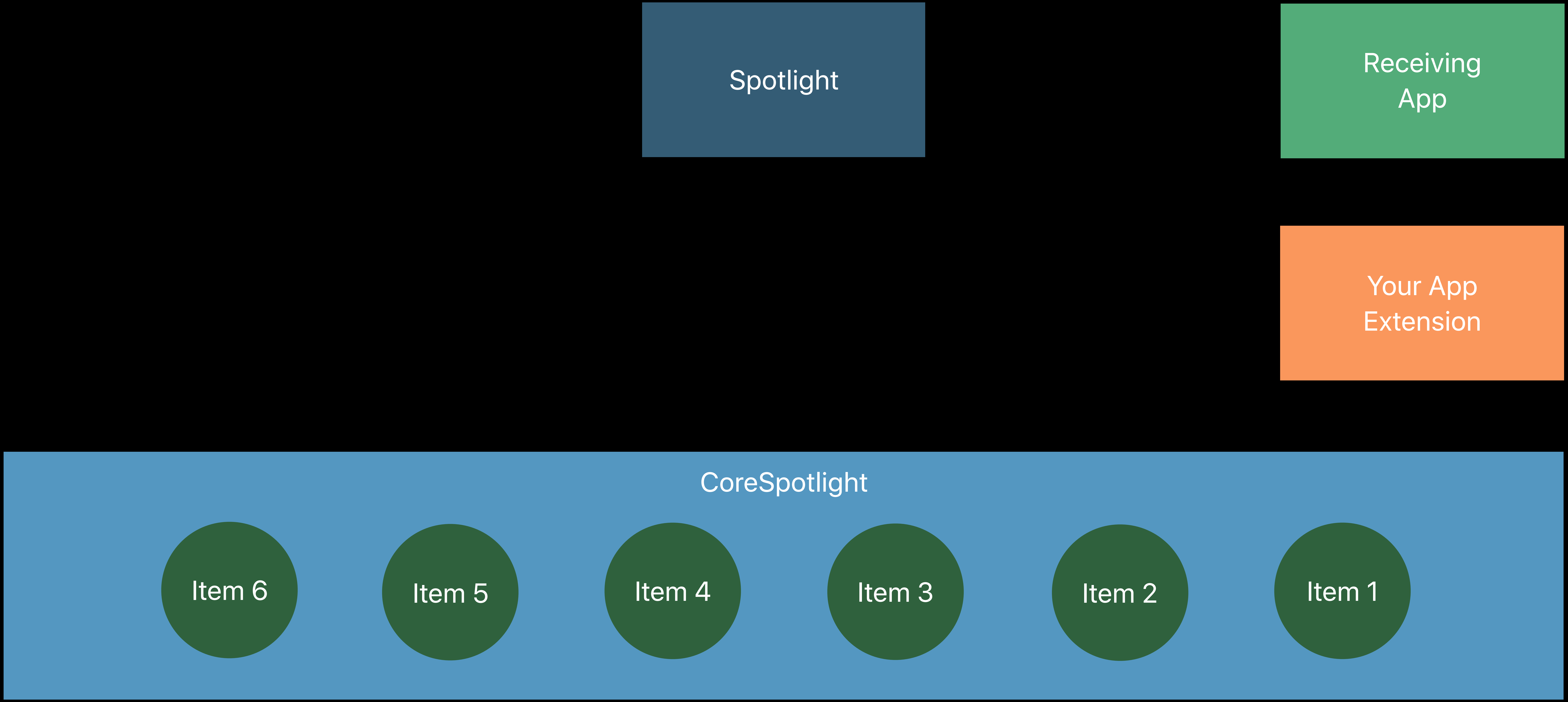
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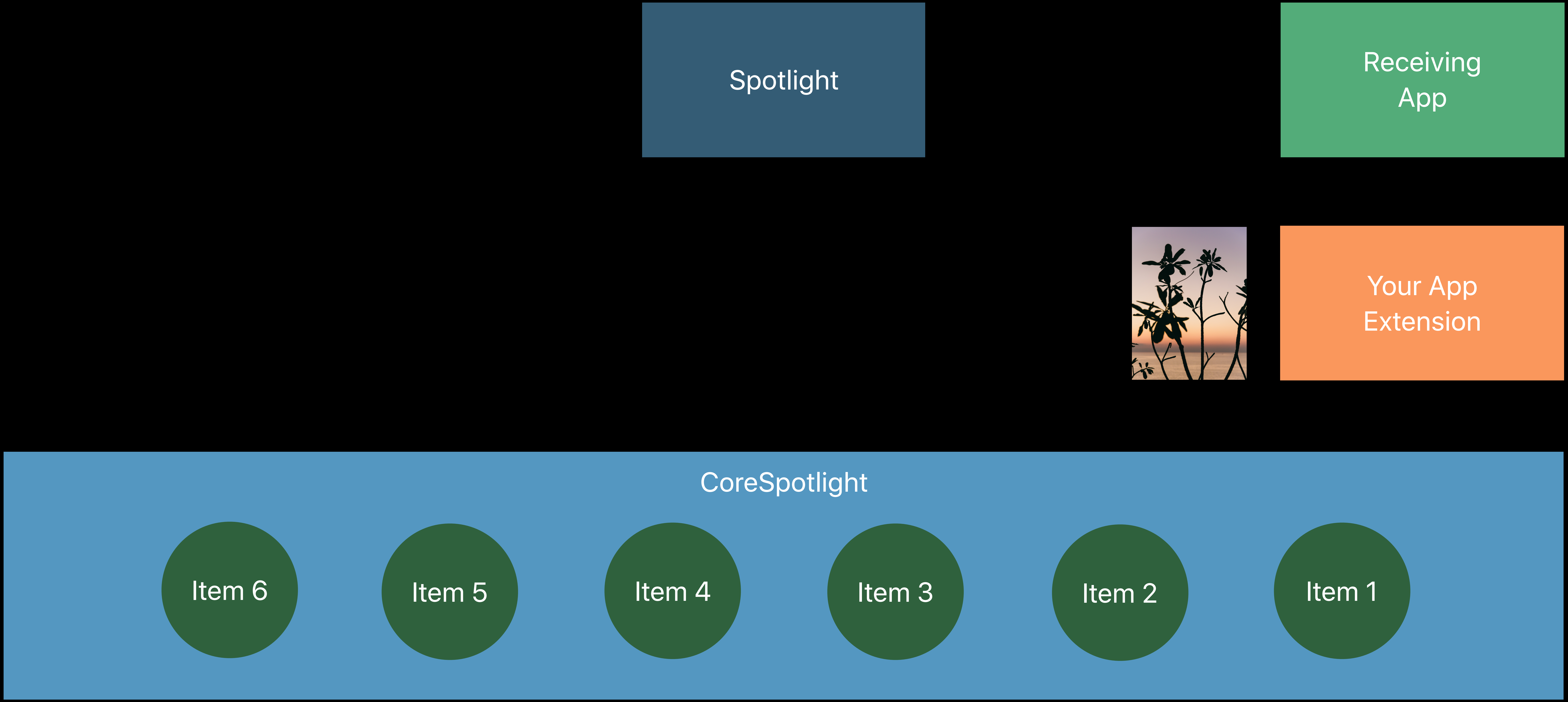
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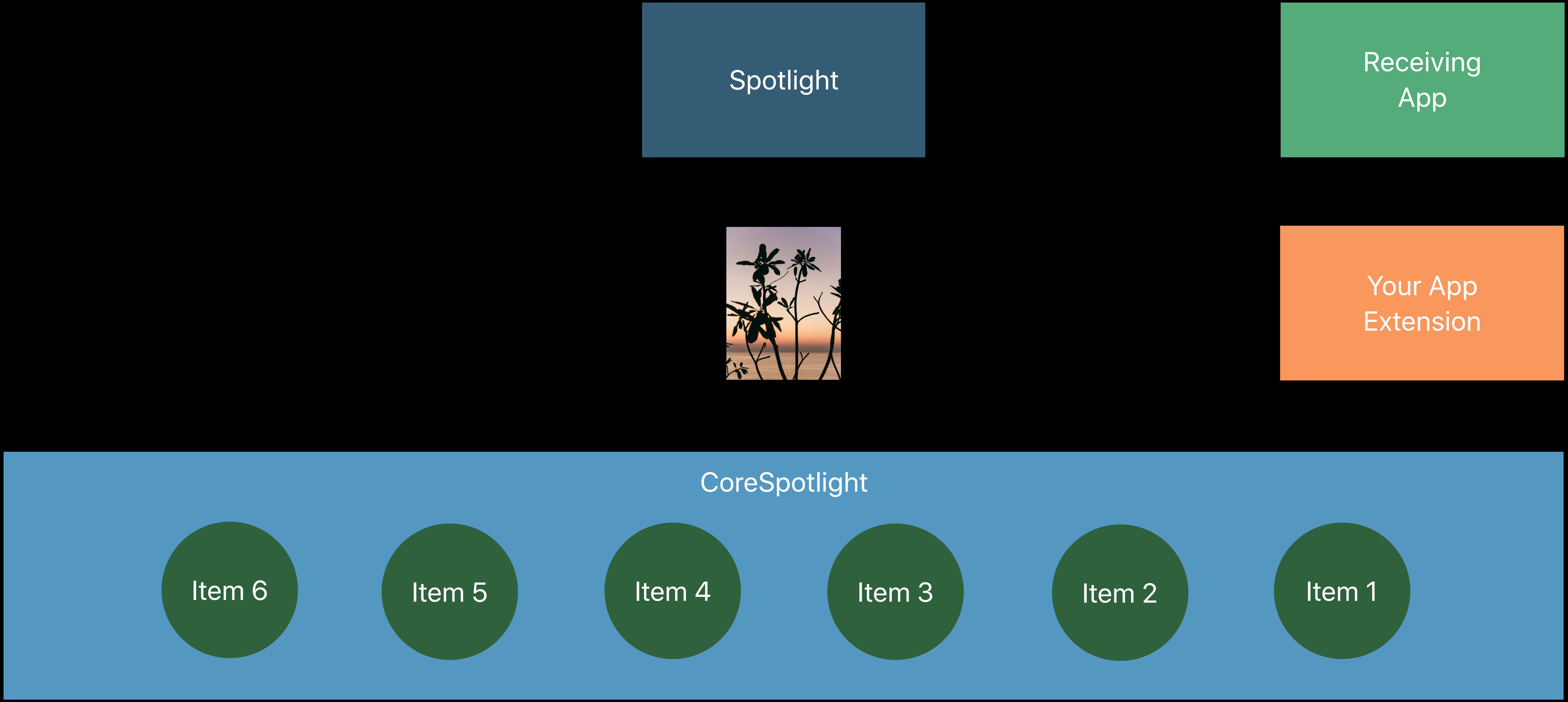
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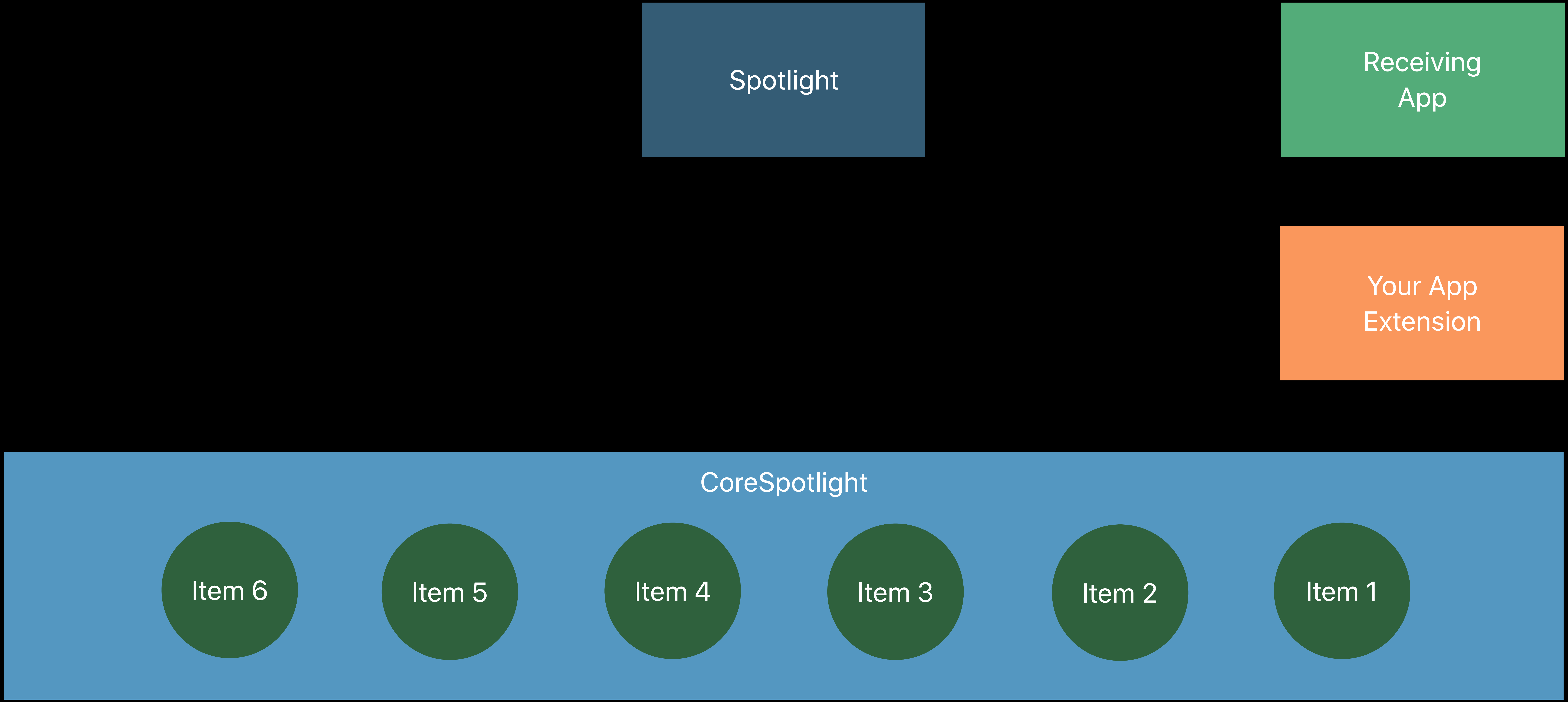
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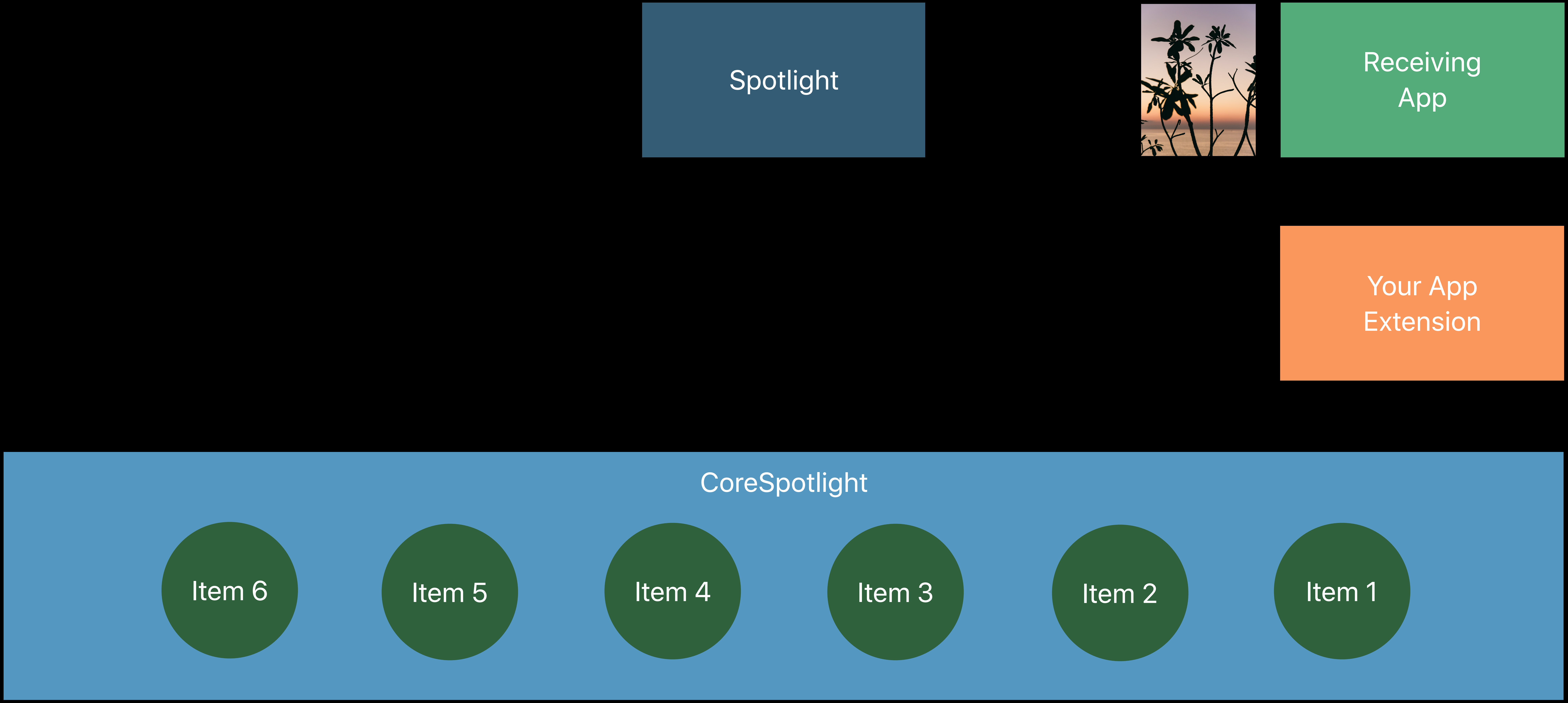
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Drag Types

Drag Types

Uniform Type Identifiers

Drag Types

Uniform Type Identifiers

- Great info on developer.apple.com

Drag Types

Uniform Type Identifiers

- Great info on developer.apple.com

Declare your own types for your data

Drag Types

Uniform Type Identifiers

- Great info on developer.apple.com

Declare your own types for your data

Use well known types for your promises

```
extension CSSearchableItemAttributeSet {

     // The string value of type identifier can only be used by one providerTypeIdentifier array.
     // An array of types identifiers that owner can provide a NSData representation for.
    open var providerDataTypeIdentifiers: [String]?

     // An array of types identifiers that owner can provided a NSURL to file representation.
     open var providerFileTypeIdentifiers: [String]?

    // An array of types identifiers that owner can provided a NSURL to inplace file
representation.
     open var providerInPlaceFileTypeIdentifiers: [String]?
}
```

```swift
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representation.
    open var providerInPlaceFileTypeIdentifiers: [String]?
}
```

```
// Setting up for drag and drop

    let attrs : CSSearchableItemAttributeSet = CSSearchableItemAttributeSet(itemContentType:
kMyType as String)

     attrs.providerFileTypeIdentifiers = [kUTTypeImage as String]
     attrs.providerDataTypeIdentifiers = [kUTTypeUTF8PlainText as String]
```

```swift
// Setting up for drag and drop

    let attrs : CSSearchableItemAttributeSet = CSSearchableItemAttributeSet(itemContentType:
kMyType as String)

     attrs.providerFileTypeIdentifiers = [kUTTypeImage as String]
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```
// Setting up for drag and drop

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kMyType as String)

     attrs.providerFileTypeIdentifiers = [kUTTypeImage as String]
     attrs.providerDataTypeIdentifiers = [kUTTypeUTF8PlainText as String]
```

```
// The developer may provided a NSData representation if type was specified in
providerDataTypeIdentifiers property.
   optional public func data(for searchableIndex: CSSearchableIndex, itemIdentifier: String,
typeIdentifier: String) throws -> Data

 // The developer may provided a NSURL to file representation representation if type was
specified from providerDataTypeIdentifiers or providerInPlaceFileTypeIdentifiers property.
   optional public func fileURL(for searchableIndex: CSSearchableIndex, itemIdentifier:
String, typeIdentifier: String, inPlace: Bool) throws -> URL
```

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// The developer may provided a NSData representation if type was specified in
providerDataTypeIdentifiers property.
   optional public func data(for searchableIndex: CSSearchableIndex, itemIdentifier: String,
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    optional public func fileURL(for searchableIndex: CSSearchableIndex, itemIdentifier:
String, typeIdentifier: String, inPlace: Bool) throws -> URL
```

```
    override func data(for searchableIndex: CSSearchableIndex, itemIdentifier: String,
typeIdentifier: String) throws -> Data
    {
        // Request indexed data for the requested picture
        var data = Data(bytes:[84,69,88,84,32,68,65,84,65])

        if var picture = Datastore.sharedDatastore.picture(identifier:itemIdentifier) {
            if typeIdentifier.isEqual(kUTTypeUTF8PlainText as String) {
                data = (picture.asciiImage?.data(using:String.Encoding.utf8))!
            }
        }

        return data
    }
    override func data(for searchableIndex: CSSearchableIndex, itemIdentifier: String,
typeIdentifier: String) throws -> Data
    {
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        return data
    }
    override func fileURL(for searchableIndex: CSSearchableIndex, itemIdentifier: String,
typeIdentifier: String, inPlace: Bool) throws -> URL
    {
        // Request indexed URL for the requested picture
        var url = URL(string:"file://")!

        if let picture = Datastore.sharedDatastore.picture(identifier:itemIdentifier) {
            if typeIdentifier.isEqual(kUTTypeImage as String) {
                url = picture.thumbnailURL!
            }
        }

        return url
    }
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```

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    override func fileURL(for searchableIndex: CSSearchableIndex, itemIdentifier: String,
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        // Request indexed URL for the requested picture
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                url = picture.thumbnailURL!
            }
        }

        return url
    }
}
```

Drag and Drop
Summary

Declare drag types at indexing time

CoreSpotlight extension is critical

- It fulfills your promises

Make it fast!

iOS and macOS

Quick Look Previews

For Core Spotlight

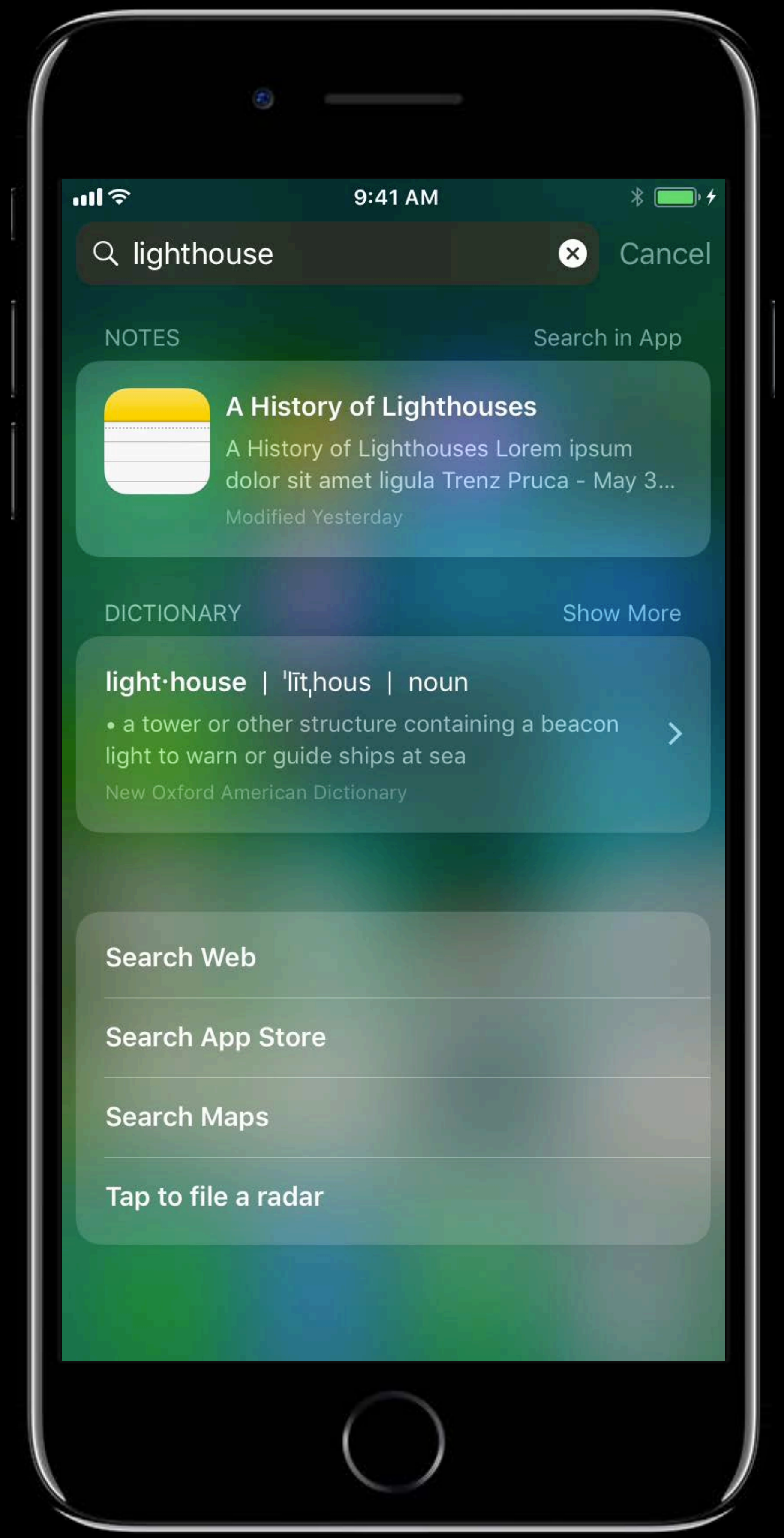
Lyn Fong, Spotlight

Previewing Your Core Spotlight Items on iOS

Content is previewed when you peek and pop on Spotlight results

Spotlight provides a default preview

Create a Quick Look Preview extension to customize your preview



9:41 AM

lighthouse

Cancel

NOTES

Search in App

A History of Lighthouses

A History of Lighthouses Lorem ipsum dolor sit amet ligula Trenz Pruca - May 3...

Modified Yesterday

DICTIONARY

Show More

light·house | ˈlītˌhous | noun

• a tower or other structure containing a beacon light to warn or guide ships at sea

New Oxford American Dictionary

Search Web

Search App Store

Search Maps

Tap to file a radar

Previewing Your Core Spotlight Items on iOS

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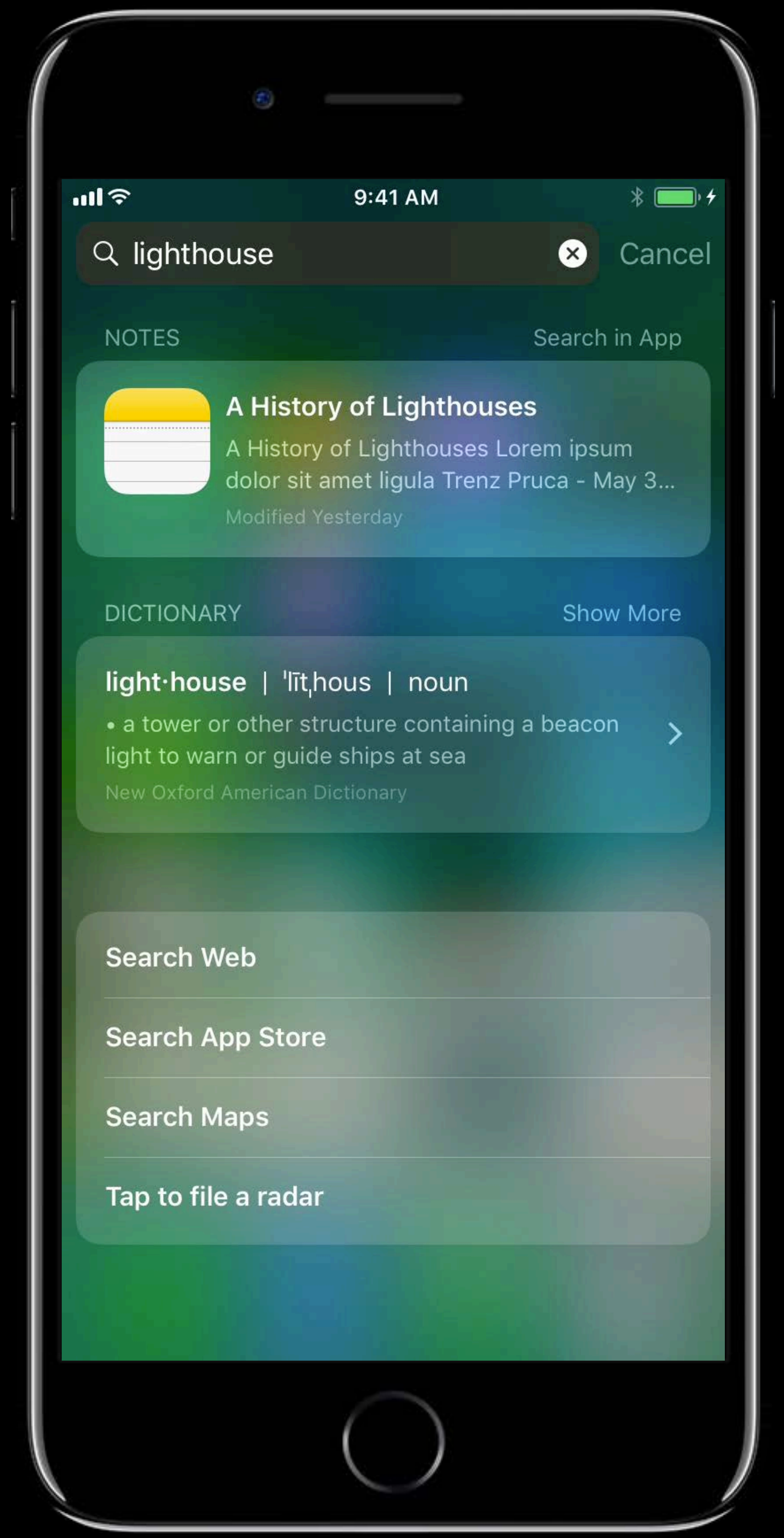
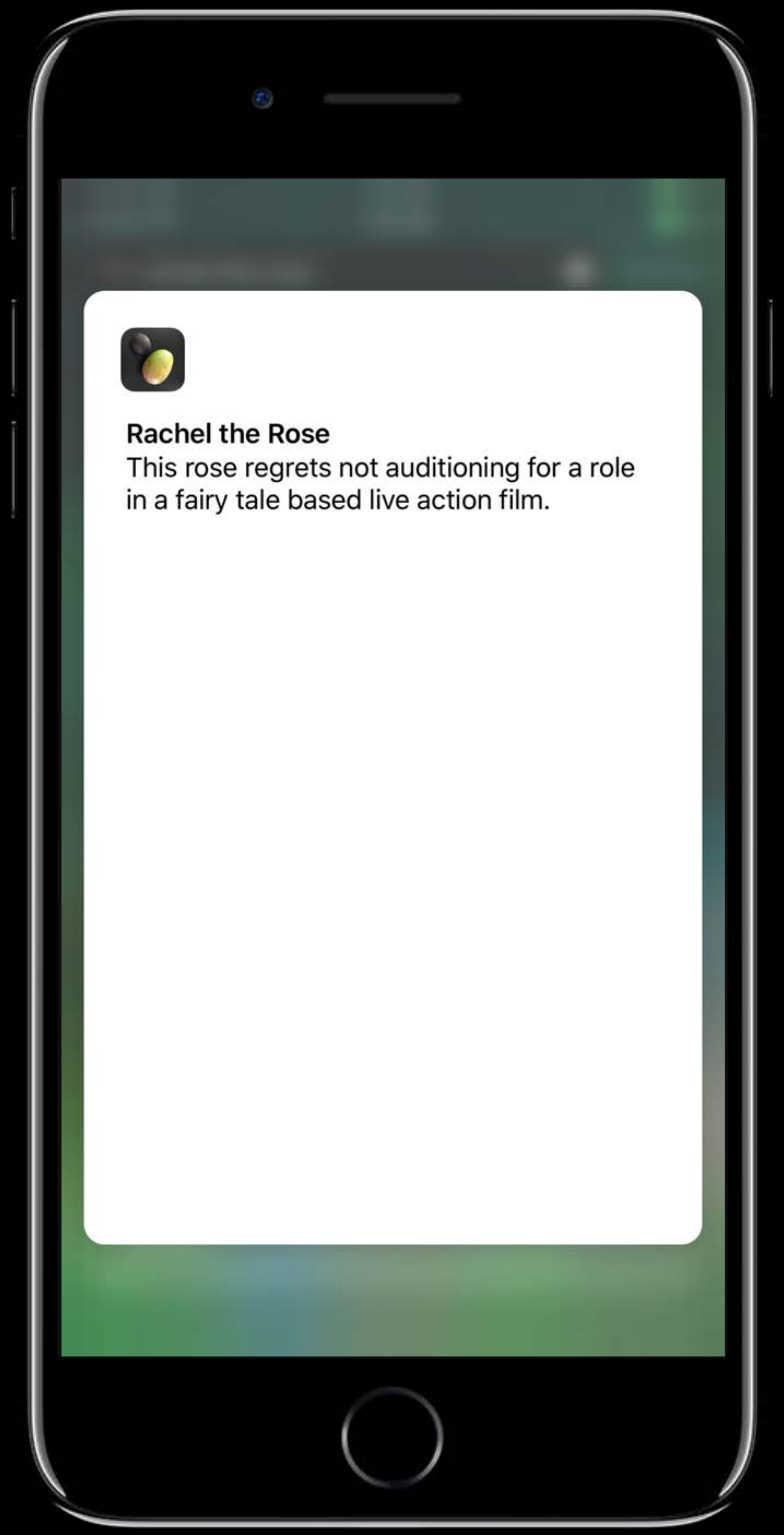


A History of Lighthouses
A History of Lighthouses Lorem ipsum dolor sit amet ligula Trenz Pruca - May 3...
Modified Yesterday

light·house | ˈlītˌhous | noun
• a tower or other structure containing a beacon light to warn or guide ships at sea
New Oxford American Dictionary

Previewing Your Core Spotlight Items on iOS

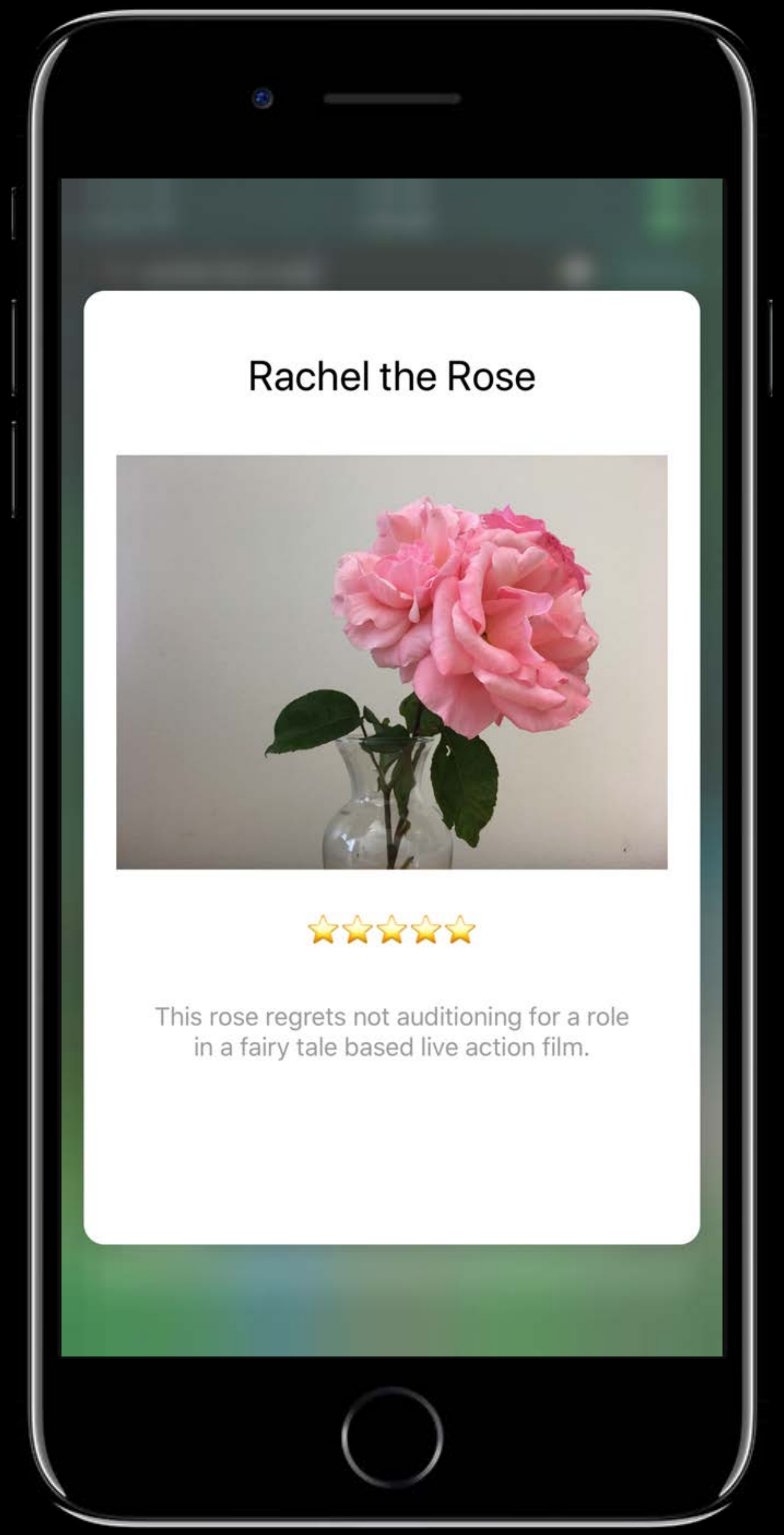
Default



Rachel the Rose
This rose regrets not auditioning for a role in a fairy tale based live action film.

Previewing Your Core Spotlight Items on iOS

Quick Look Preview extension

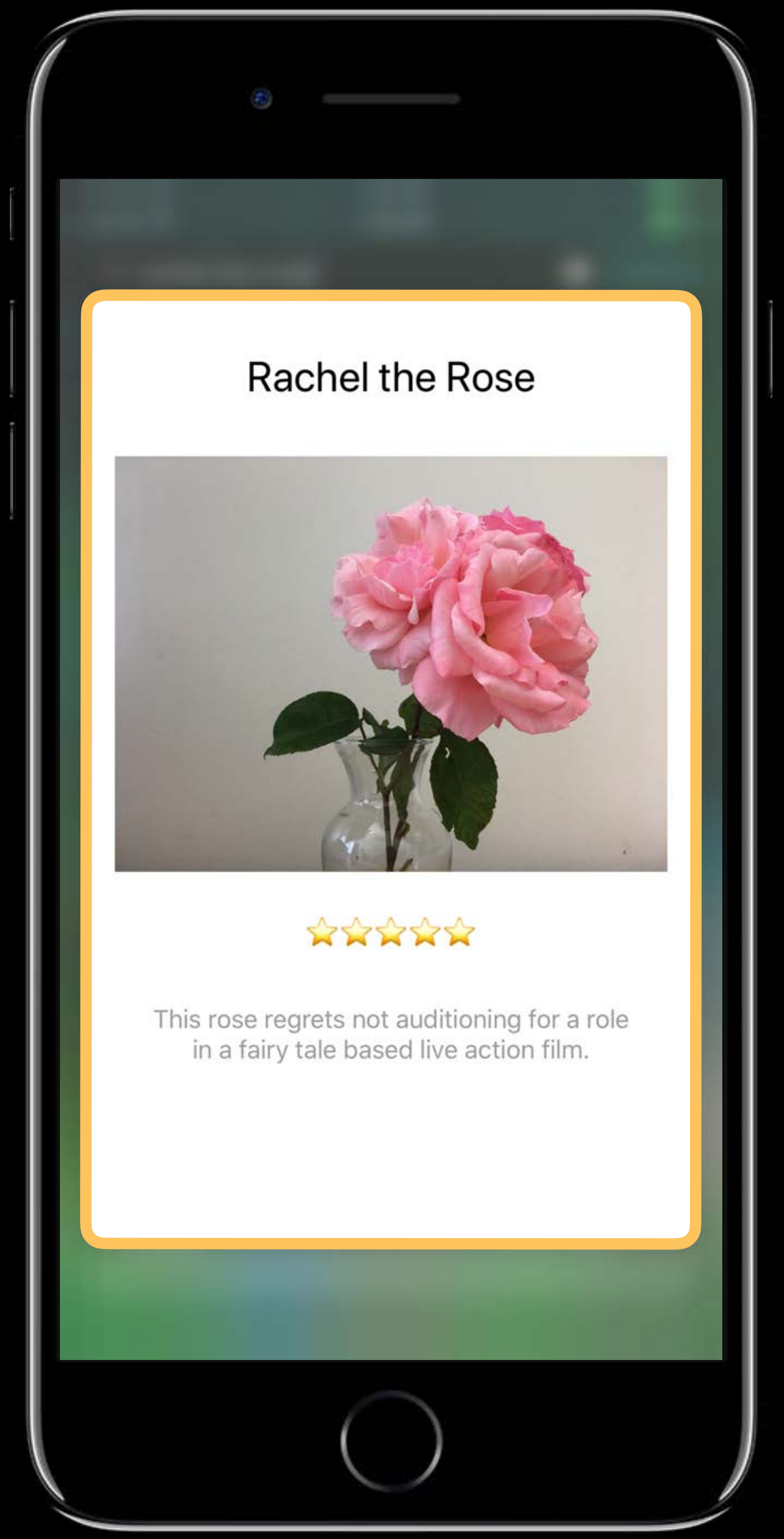

Rachel the Rose

⭐⭐⭐⭐⭐

This rose regrets not auditioning for a role in a fairy tale based live action film.

Previewing Your Core Spotlight Items on iOS

Quick Look Preview extension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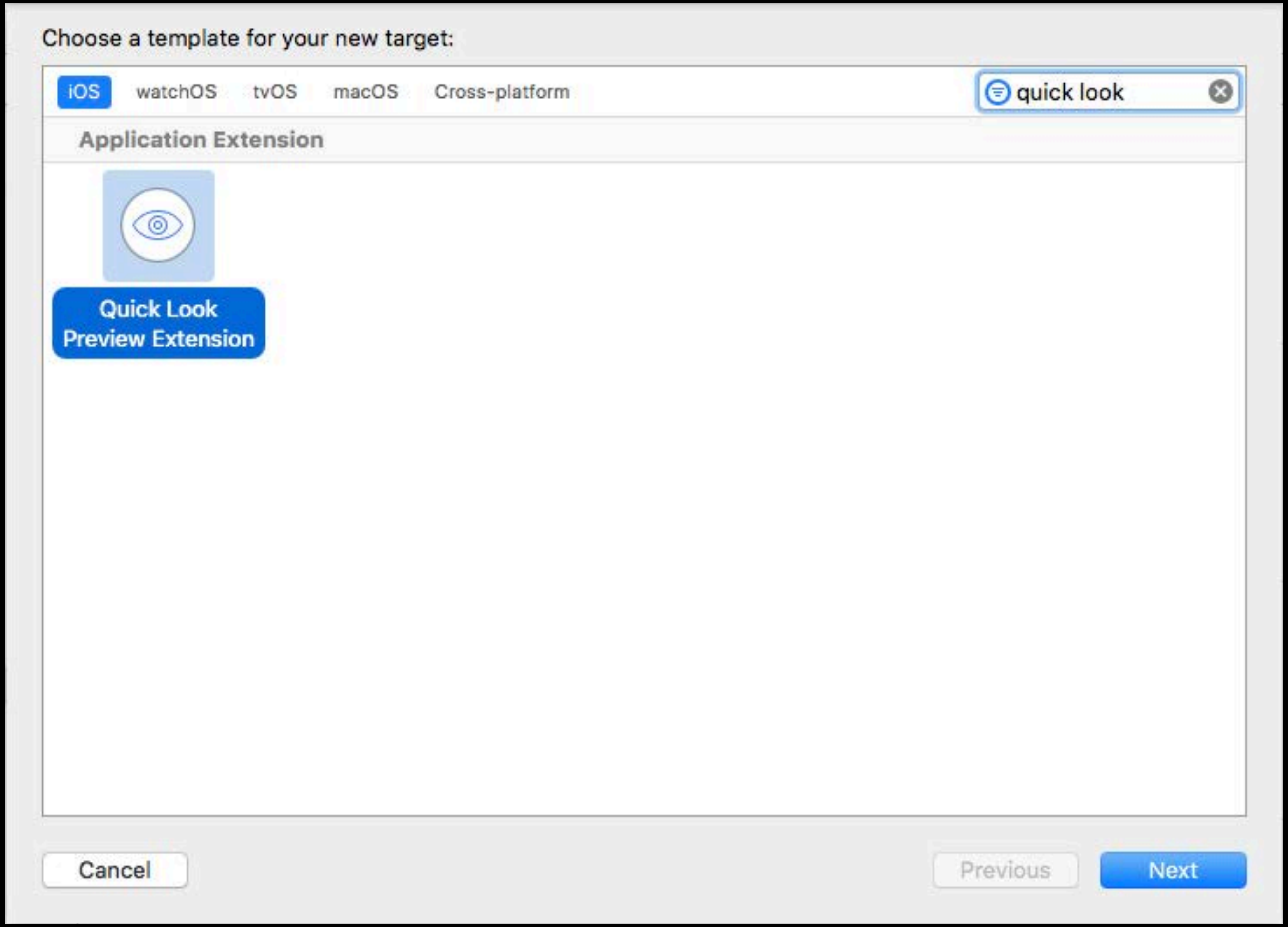
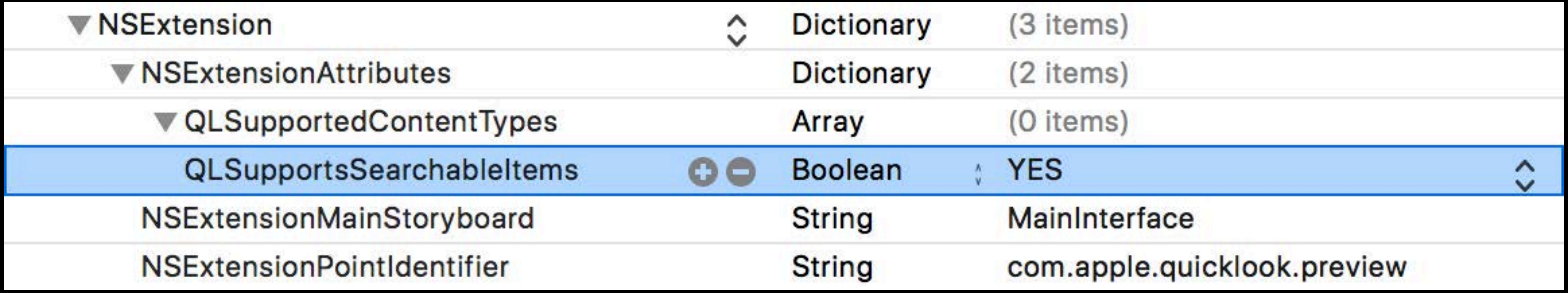
Previewing Your Core Spotlight Items on iOS



Previewing Your Core Spotlight Items on iOS



▼ NSExtension	Dictionary	(3 items)
▼ NSExtensionAttributes	Dictionary	(2 items)
▼ QLSupportedContentTypes	Array	(0 items)
QLSupportsSearchableItems	Boolean	YES
NSExtensionMainStoryboard	String	MainInterface
NSExtensionPointIdentifier	String	com.apple.quicklook.preview

```swift
// Quick Look Core Spotlight Preview API

func preparePreviewOfSearchableItem(identifier: String, queryString: String?,
        completionHandler handler: @escaping QLPreviewItemLoadingBlock) {

        //retrieve the searched for content from the identifier
        let content = findContent(identifier: identifier)

        //setup your view based on the content retrieved
        setupViewForContent(content: content)

        //make sure you call the completion handler once you're done
        handler(nil)
}
```

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Previewing Your Core Spotlight Items on iOS

Debugging

Not your typical extension workflow

Pick any host app

Launch from Spotlight

Xcode will attach when the extension is launched in Spotlight

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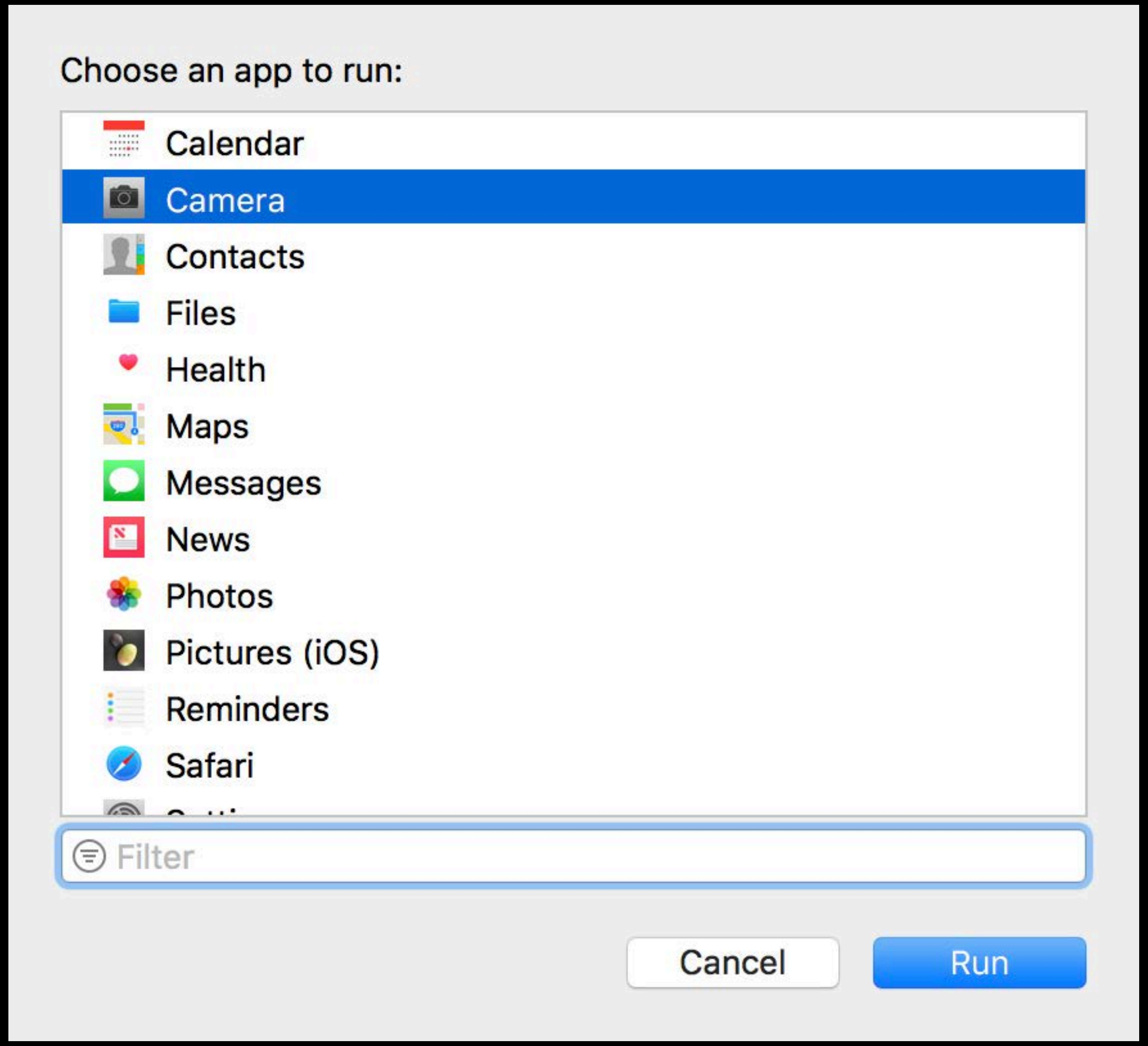

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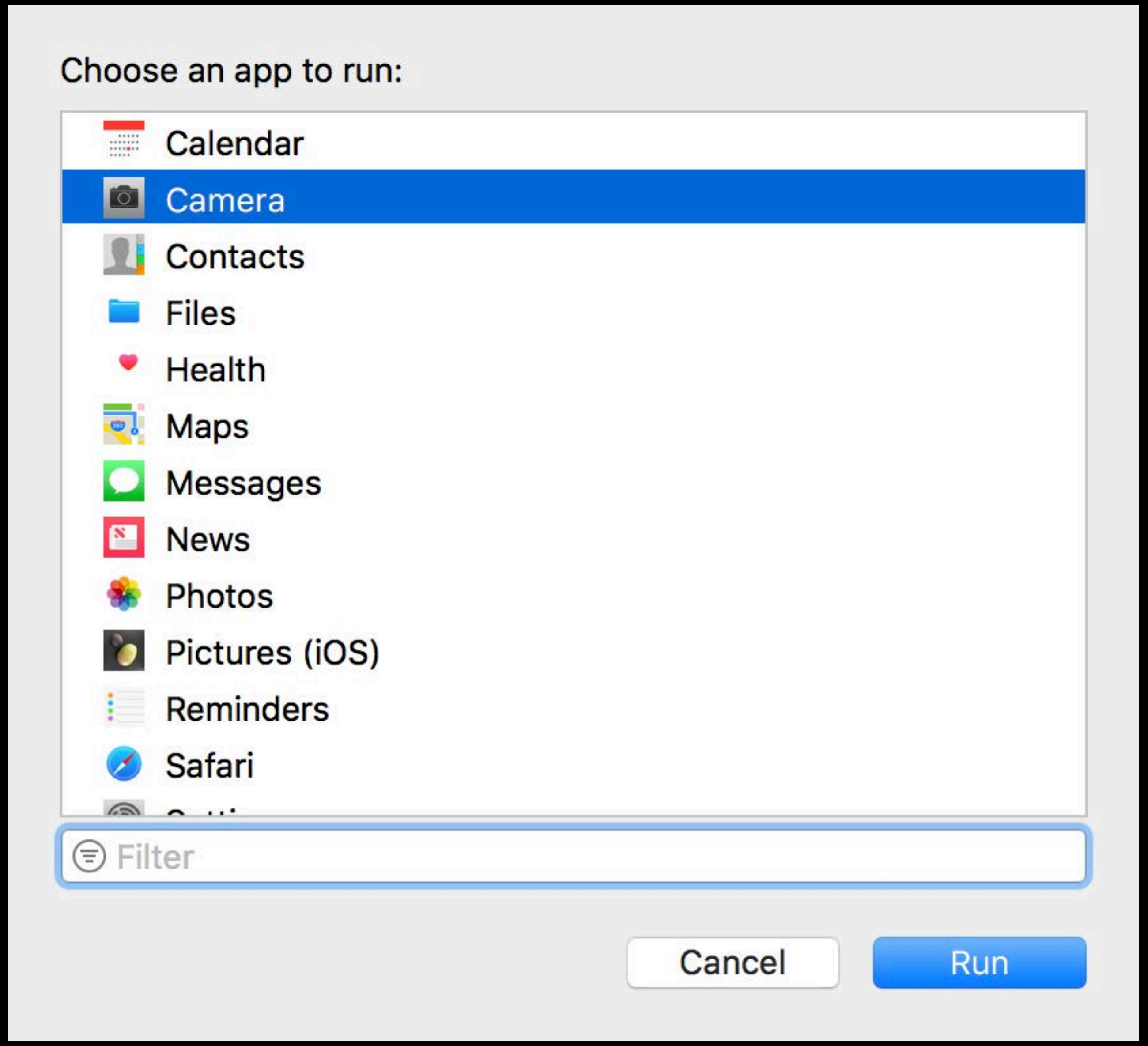


Demo

Core Spotlight Previews on iOS

Previewing Your Core Spotlight Items on iOS

Final tips

Be fast!

Call the completion handler as soon as possible to avoid

Be memory efficient in an extension

No background work after calling the completion handler

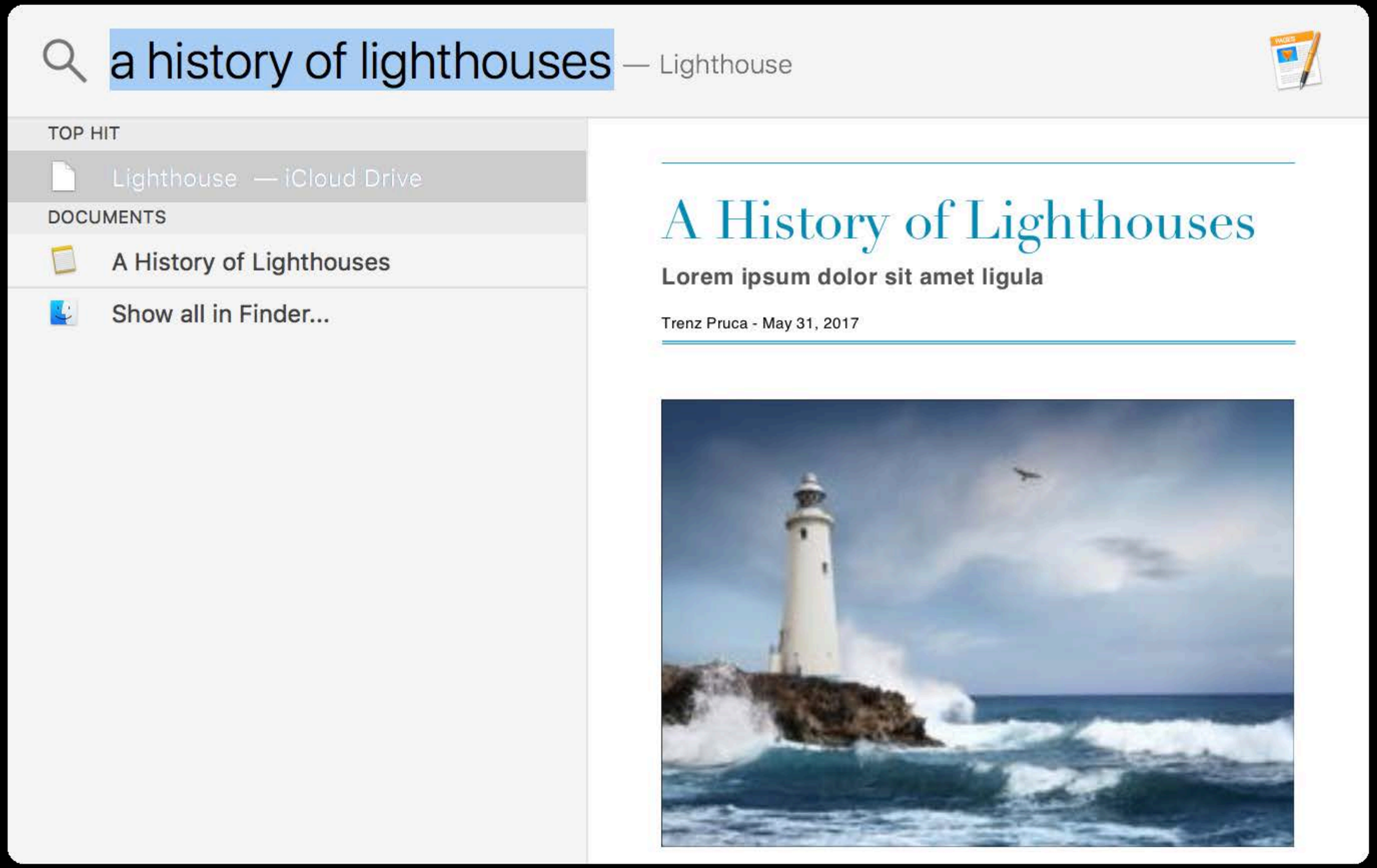
Building Great Document-Based Apps in iOS 11 Hall 2 Thursday 1:50PM

Previewing Your Core Spotlight Items on MacOS

Content is previewed when you select a result in Spotlight

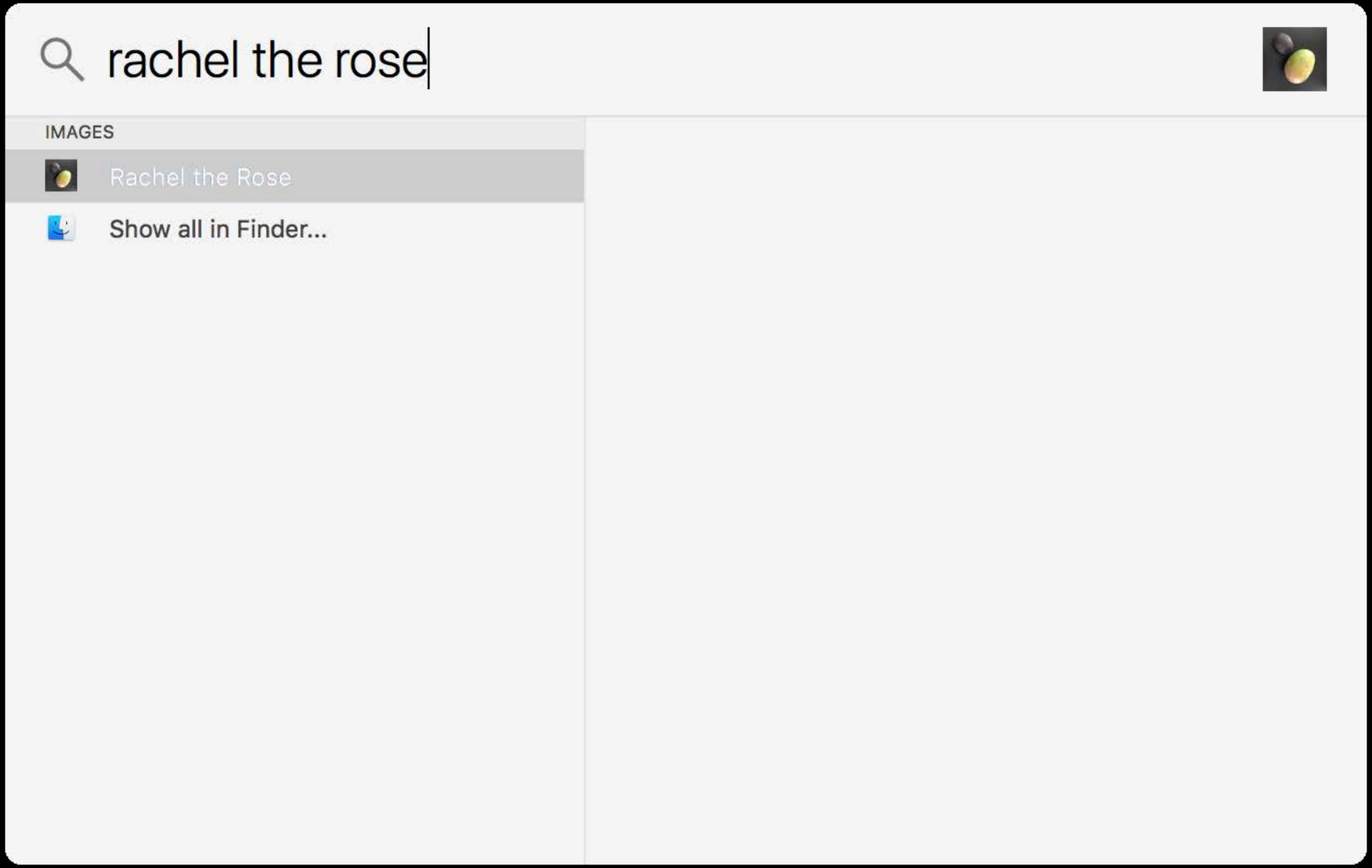
Spotlight provides no preview

Create a Quick Look Preview extension to provide a preview


a history of lighthouses — Lighthouse
TOP HIT
Lighthouse — iCloud Drive
DOCUMENTS
A History of Lighthouses
Show all in Finder...
A History of Lighthouses
Lorem ipsum dolor sit amet ligula
Trenz Pruca - May 31, 2017

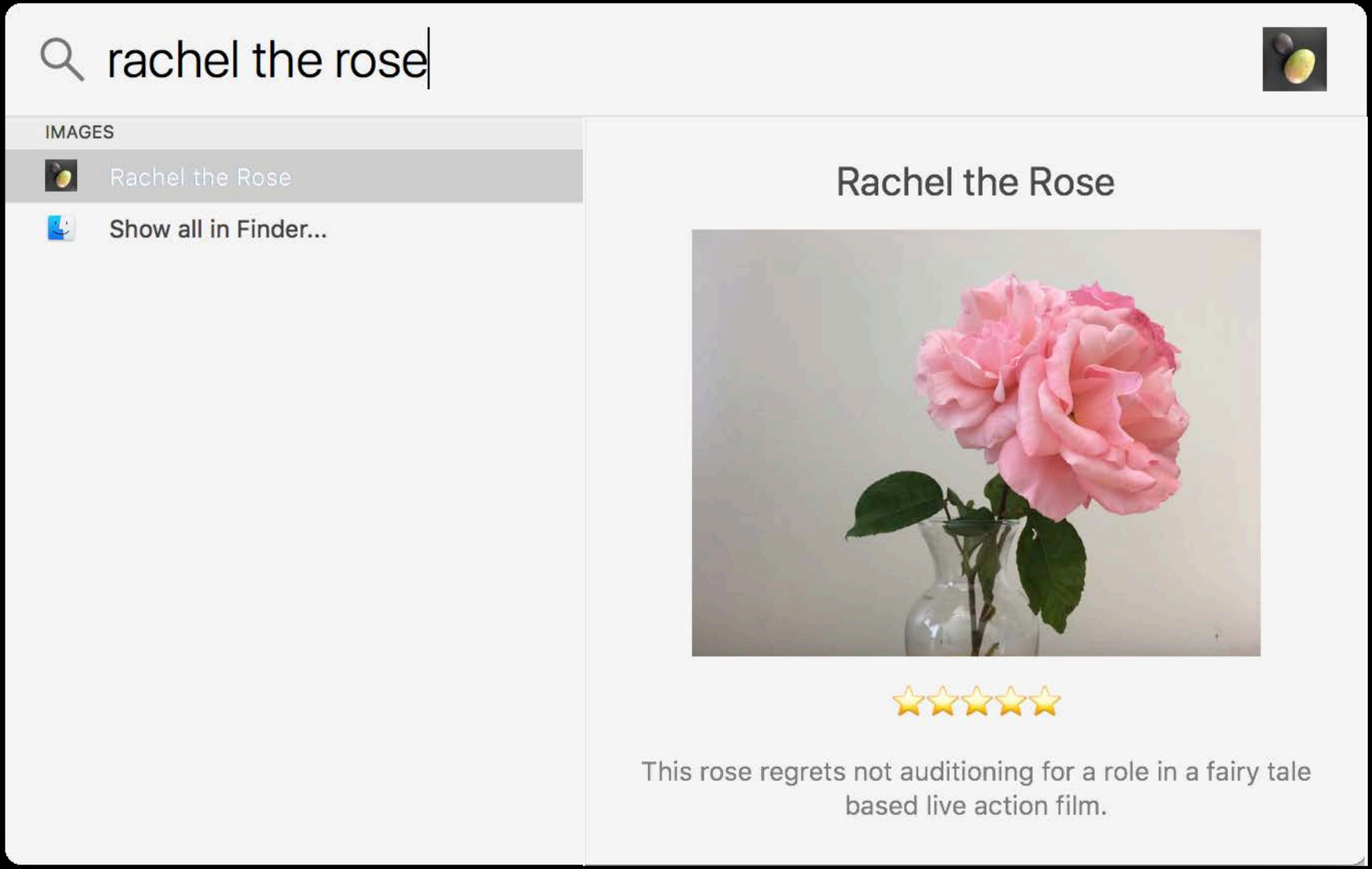
Previewing Your Core Spotlight Items on MacOS

Default



Previewing Your Core Spotlight Items on MacOS

Quick Look Preview extension



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Previewing Your Core Spotlight Items on MacOS

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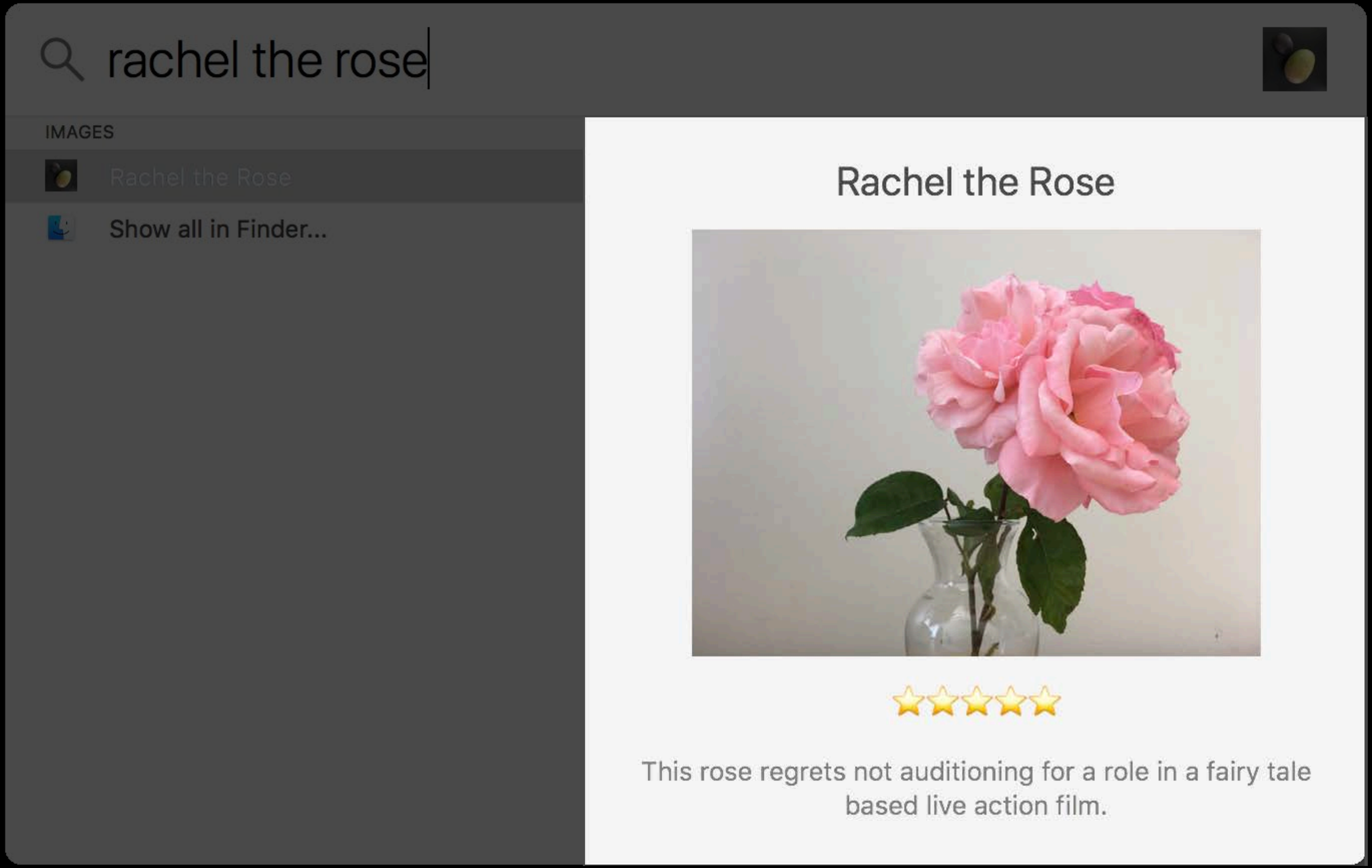

This rose regrets not auditioning for a role in a fairy tale based live action film.

Previewing Your Core Spotlight Items on MacOS

Debugging

Not your typical extension workflow

Spotlight vanishes if Xcode has focus

Use the Quick Look Simulator instead

Demo

Core Spotlight Previews on MacOS

Previewing Your Core Spotlight Items on MacOS

More information and tips

Be fast and memory efficient!

No first responder in the extension

Preview is not meant to be interactive

Supports only Core Spotlight items

Ranking

Ranking

Machine-learning-based ranker

Ranking

Machine-learning-based ranker

Personalized and adaptive

Ranking

Machine-learning-based ranker

Personalized and adaptive

Runs on device

Ranking

Machine-learning-based ranker

Personalized and adaptive

Runs on device

Private

Ranking

Machine-learning-based ranker

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Private

Ranking

NEW

New attributes to let you inform our ranking

Ranking

NEW

New attributes to let you inform our ranking

```
  // (1–100 , 100 being better)
open var rankingHint: NSNumber?
```

Ranking

NEW

New attributes to let you inform our ranking

```
  // (1–100 , 100 being better)
open var rankingHint: NSNumber?
```

```
 // Boolean attribute, set to true if the user created the item
 open var userCreated: NSNumber?
```

Ranking

NEW

New attributes to let you inform our ranking

```
  // (1-100 , 100 being better)
open var rankingHint: NSNumber?
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```
// Boolean attribute, set to true if the user created the item
open var userCreated: NSNumber?
```

```
// Boolean attribute, set to true if the user purchased the item
open var userOwned: NSNumber?
```

Ranking

NEW

New attributes to let you inform our ranking

```
  // (1–100 , 100 being better)
open var rankingHint: NSNumber?
```

```
// Boolean attribute, set to true if the user created the item
open var userCreated: NSNumber?
```

```
// Boolean attribute, set to true if the user purchased the item
open var userOwned: NSNumber?
```

```
// Boolean attribute, set to true if the user selected/favorited/collected the item
open var userCurated: NSNumber?
```

Ranking Tips and Tricks

Ranking Tips and Tricks

Match quality and usage information is critical for ranking

Ranking Tips and Tricks

Match quality and usage information is critical for ranking

Use NSUserActivity to provide usage information from your app

Ranking Tips and Tricks

Match quality and usage information is critical for ranking

Use NSUserActivity to provide usage information from your app

Provide rich metadata for ranking

- Title
- Description
- Dates
- Keywords

CoreSpotlight Refresher

CoreSpotlight Refresher

Indexing CSSearchableItem

CoreSpotlight Refresher

Indexing CSSearchableItem

Indexing NSUserActivity

CoreSpotlight Refresher

Indexing CSSearchableItem

Indexing NSUserActivity

Deleting indexed items

CoreSpotlight Refresher

Indexing CSSearchableItem

CoreSpotlight Refresher

Indexing CSSearchableItem

Items for all that your app has to offer

CoreSpotlight Refresher
Indexing CSSearchableItem

Items for all that your app has to offer

```
let attributes = CSSearchableItemAttributeSet(itemContentType: kUTTypeImage as String)
attributes.displayName = name
let item = CSSearchableItem(uniqueIdentifier: identifier,
                            domainIdentifier: "mydomain", attributeSet: attributes)
let index = CSSearchableIndex.default()
index.indexSearchableItems(items, completionHandler: handler)
```

CoreSpotlight Refresher

Indexing CSSearchableItem

Items for all that your app has to offer

```
let attributes = CSSearchableItemAttributeSet(itemContentType: kUTTypeImage as String)
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CoreSpotlight Refresher

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CoreSpotlight Refresher

Indexing NSUserActivity

CoreSpotlight Refresher

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NSUserActivity can be used to index content and navigation points in your app

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CoreSpotlight Refresher

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CoreSpotlight Refresher

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Relate NSUserActivities to CSSearchableItems to help ranking

CoreSpotlight Refresher

Indexing NSUserActivity

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- CSSearchableItem reflects what your app has

Relate NSUserActivities to CSSearchableItems to help ranking

```
let attributes = CSSearchableItemAttributeSet(itemContentType: kUTTypeImage)
attributes.displayName = ”Private content!”
attributes.relatedUniqueIdentifier = "myIdentifier"

let userActivity = NSUserActivity(activityType: ”myActivityType");
userActivity.eligibleForSearch = true
userActivity.contentAttributeSet = attributes
```

CoreSpotlight Refresher

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CoreSpotlight Refresher

Deleting items

CoreSpotlight Refresher

Deleting items

Clear items deleted by the user

CoreSpotlight Refresher

Deleting items

Clear items deleted by the user

Dispose of stale content

CoreSpotlight Refresher

Deleting items

Clear items deleted by the user

Dispose of stale content

```
let index = CSSearchableIndex.default()

index.deleteSearchableItems(withIdentifiers:["hello"], completionHandler: handler)

index.deleteSearchableItems(withDomainIdentifiers:["Greetings"], completionHandler:
handler)

index.deleteAllSearchableItems(completionHandler:handler)
```

CoreSpotlight Refresher

Deleting items

Clear items deleted by the user

Dispose of stale content

```
    let index = CSSearchableIndex.default()

    index.deleteSearchableItems(withIdentifiers:["hello"], completionHandler: handler)

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CoreSpotlight Refresher
Deleting items

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```

CoreSpotlight Indexing
Getting it right

Registering as an index delegate

Creating a CoreSpotlight extension

Use client state

Performance considerations

Index Delegate

Responsibilities

Index Delegate

Responsibilities

Full reindexing

Index Delegate
Responsibilities

Full reindexing

Selective reindexing

Index Delegate

Responsibilities

Full reindexing

Selective reindexing

Reacting to index throttling

Index Delegate

Responsibilities

Full reindexing

Selective reindexing

Reacting to index throttling

Drag and drop

Index Delegate

Responsibilities

Full reindexing

Selective reindexing

Reacting to index throttling

Drag and drop

```
//Register as the index delegate
CSSearchableIndex.default().indexDelegate = self
```

```
public protocol CSSearchableIndexDelegate : NSObjectProtocol {

// Indexing
    public func searchableIndex(_ searchableIndex: CSSearchableIndex,
reindexAllSearchableItemsWithAcknowledgementHandler acknowledgementHandler: @escaping () ->
Swift.Void)
    public func searchableIndex(_ searchableIndex: CSSearchableIndex,
reindexSearchableItemsWithIdentifiers identifiers: [String], acknowledgementHandler: @escaping
() -> Swift.Void)

    optional public func searchableIndexDidThrottle(_ searchableIndex: CSSearchableIndex)
    optional public func searchableIndexDidFinishThrottle(_ searchableIndex:
CSSearchableIndex)

//Drag and drop
    optional public func data(for searchableIndex: CSSearchableIndex, itemIdentifier: String,
typeIdentifier: String) throws -> Data
    optional public func fileURL(for searchableIndex: CSSearchableIndex, itemIdentifier:
String, typeIdentifier: String, inPlace: Bool) throws -> URL
}
```

```
public protocol CSSearchableIndexDelegate : NSObjectProtocol {

// Indexing
    public func searchableIndex(_ searchableIndex: CSSearchableIndex,
reindexAllSearchableItemsWithAcknowledgementHandler acknowledgementHandler: @escaping () ->
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//Drag and drop
    optional public func data(for searchableIndex: CSSearchableIndex, itemIdentifier: String,
typeIdentifier: String) throws -> Data
    optional public func fileURL(for searchableIndex: CSSearchableIndex, itemIdentifier:
String, typeIdentifier: String, inPlace: Bool) throws -> URL
}
```

```
// Called when everything needs to be indexed

    func searchableIndex(_: CSSearchableIndex,
reindexAllSearchableItemsWithAcknowledgementHandler acknowledgementHandler: @escaping () ->
Void) {
        let group = DispatchGroup()
        //get all items, index asynchronously
        //…
        //call the acknowledgement handle when indexing has completed
        group.notify(queue:dataStore.queue) {
            acknowledgementHandler()
        }
    }
```

```
// Called when select items needs to be indexed

    func searchableIndex(_: CSSearchableIndex, reindexSearchableItemsWithIdentifiers
                         identifiers: [String], acknowledgementHandler: @escaping () -> Void)
{
        let group = DispatchGroup()
        //look up requested items, and index them asynchronously
        //…
        //call the acknowledgement handle when indexing has completed
        group.notify(queue:dataStore.queue) {
            acknowledgementHandler()
        }
    }
```

CoreSpotlight Extension

Catching up in the background

CoreSpotlight Extension
Catching up in the background

Provide a CoreSpotlight extension

CoreSpotlight Extension

Catching up in the background

Provide a CoreSpotlight extension

- The extension can index when your app isn’t running
- Same interface as the index delegate

CoreSpotlight Extension

Catching up in the background

Provide a CoreSpotlight extension

- The extension can index when your app isn’t running
- Same interface as the index delegate

```
//reindex all searchable items for you app
public func searchableIndex(_ searchableIndex: CSSearchableIndex,
reindexAllSearchableItemsWithAcknowledgementHandler
           acknowledgementHandler: @escaping () -> Swift.Void)

//reindex select items for you app
public func searchableIndex(_ searchableIndex: CSSearchableIndex,
reindexSearchableItemsWithIdentifiers identifiers: [String],
           acknowledgementHandler: @escaping () -> Swift.Void)
```

Using Client State

Using Client State

Makes it easy to keep your data store and Spotlight in sync

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An opaque token stored in Spotlight’s index

- You own it
- You decide what it means

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Often a sequence number

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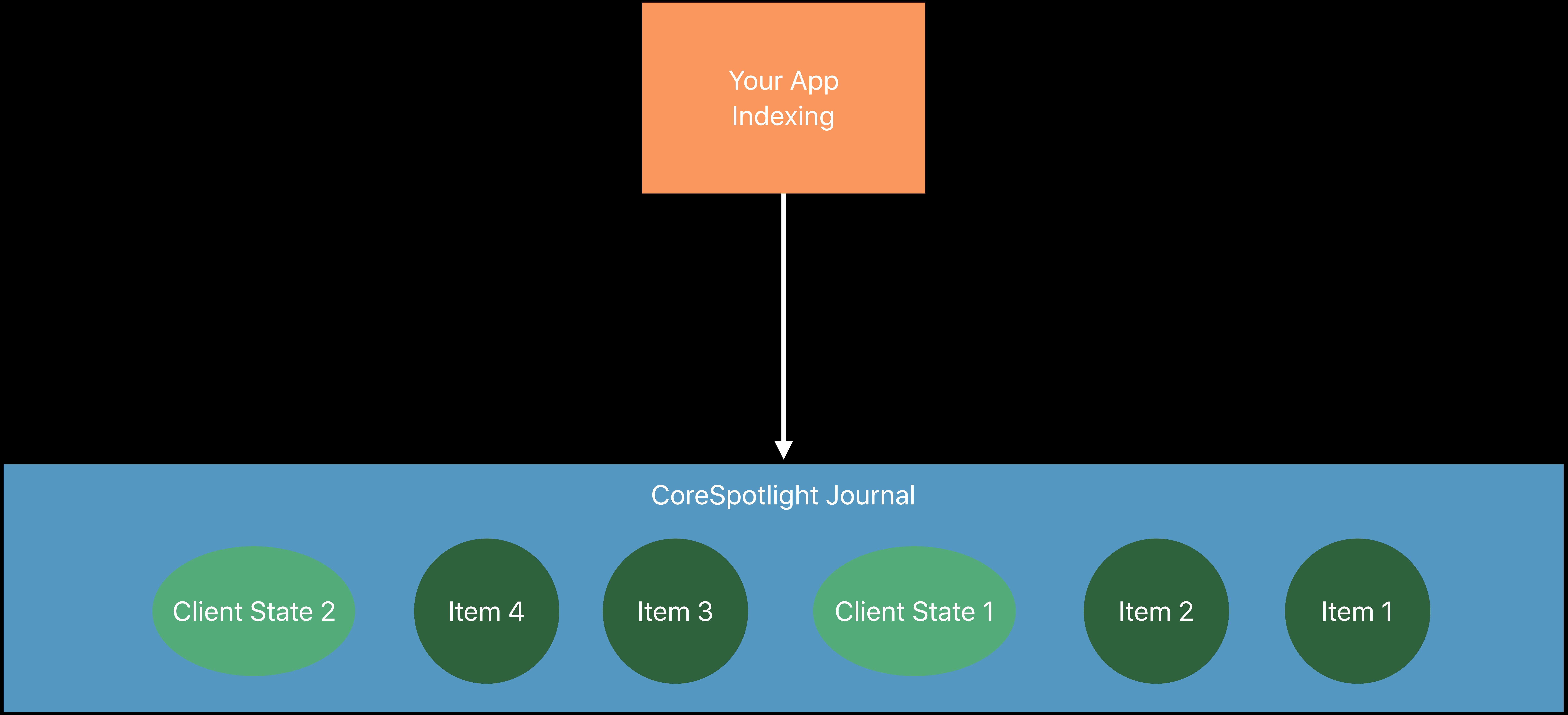
Often a sequence number

Great with journals or database annotations

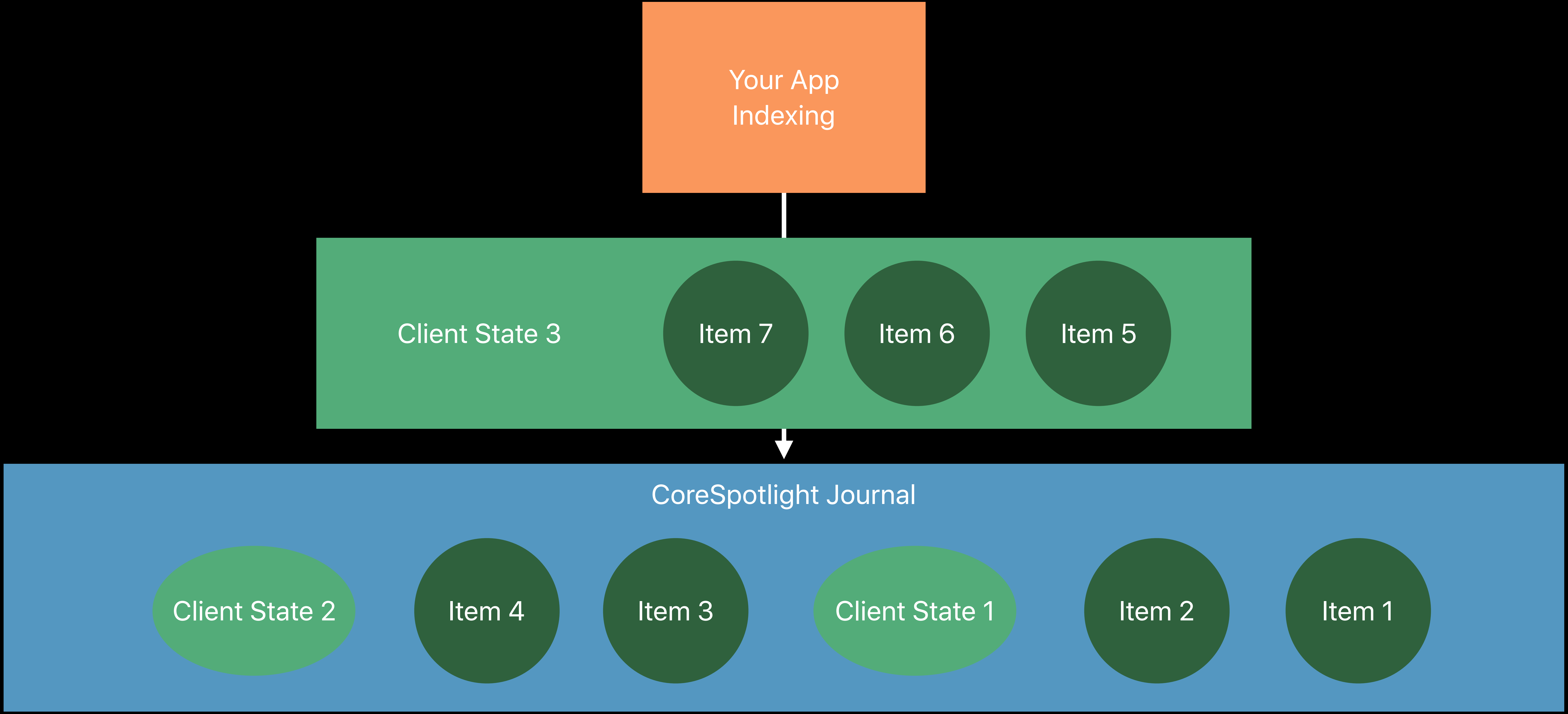
Batching and Client State

Indexing



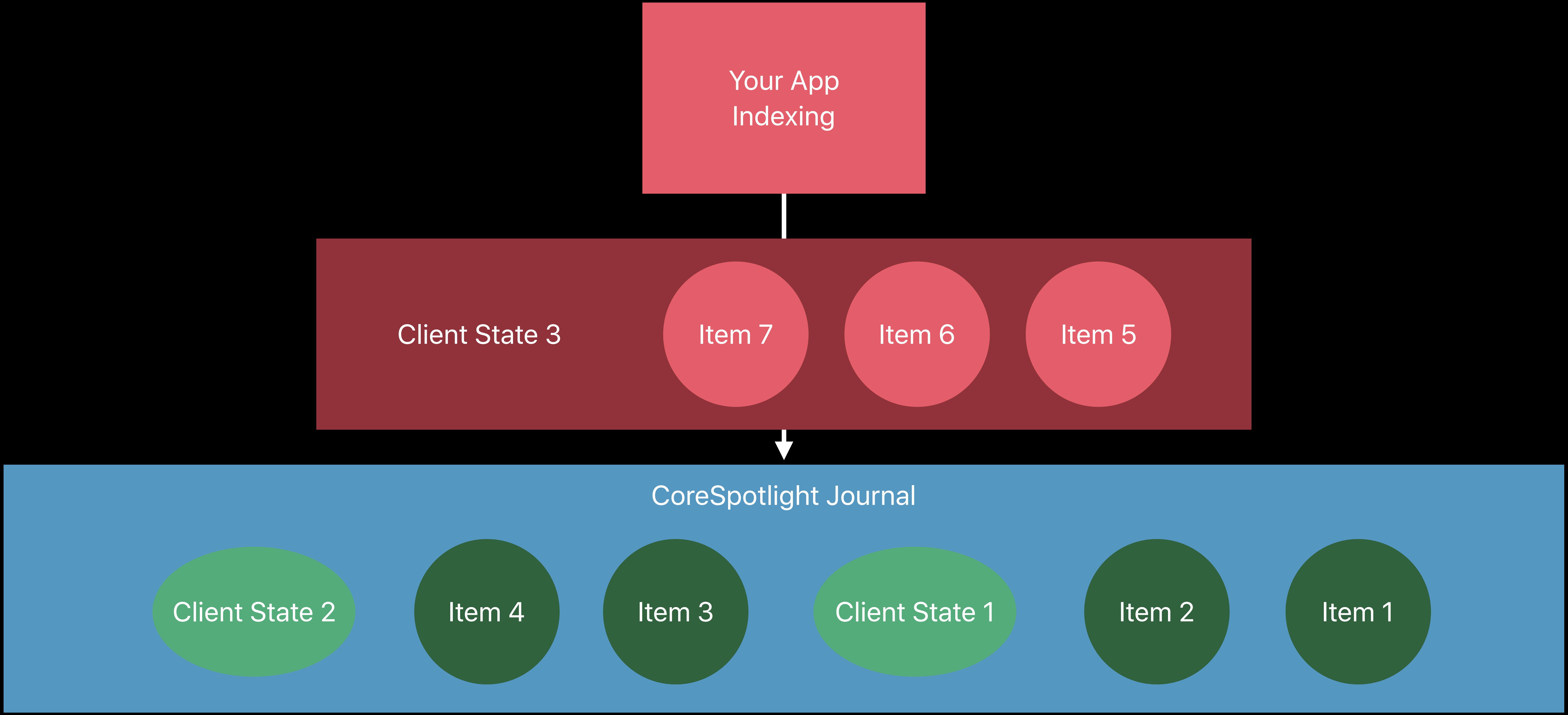
Batching and Client State

Indexing



Batching and Client State

Disaster



Batching and Client State

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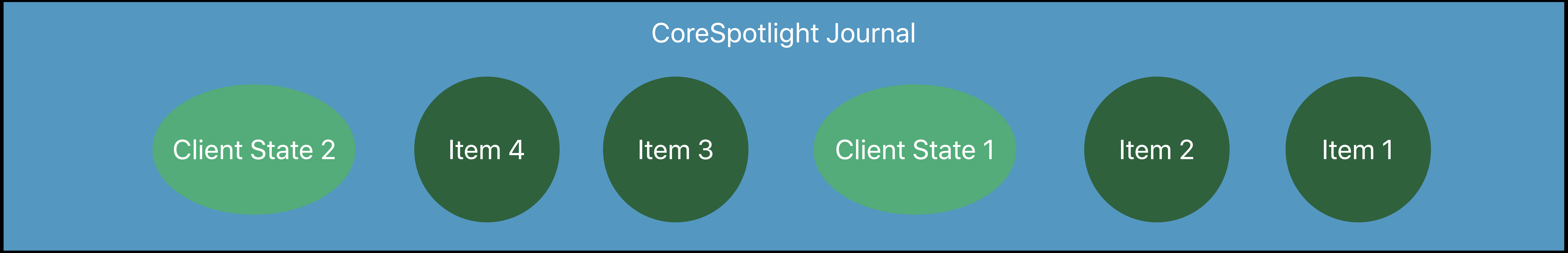
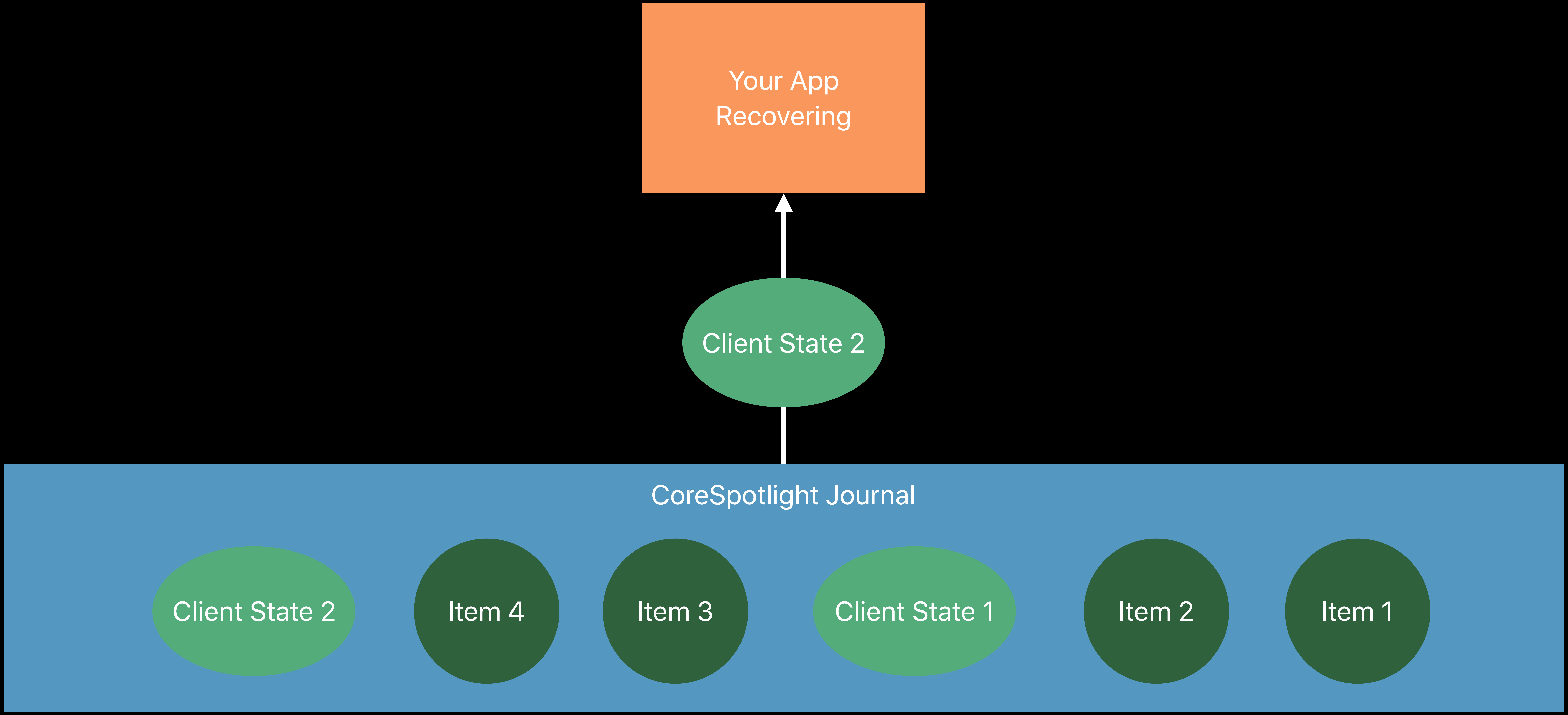


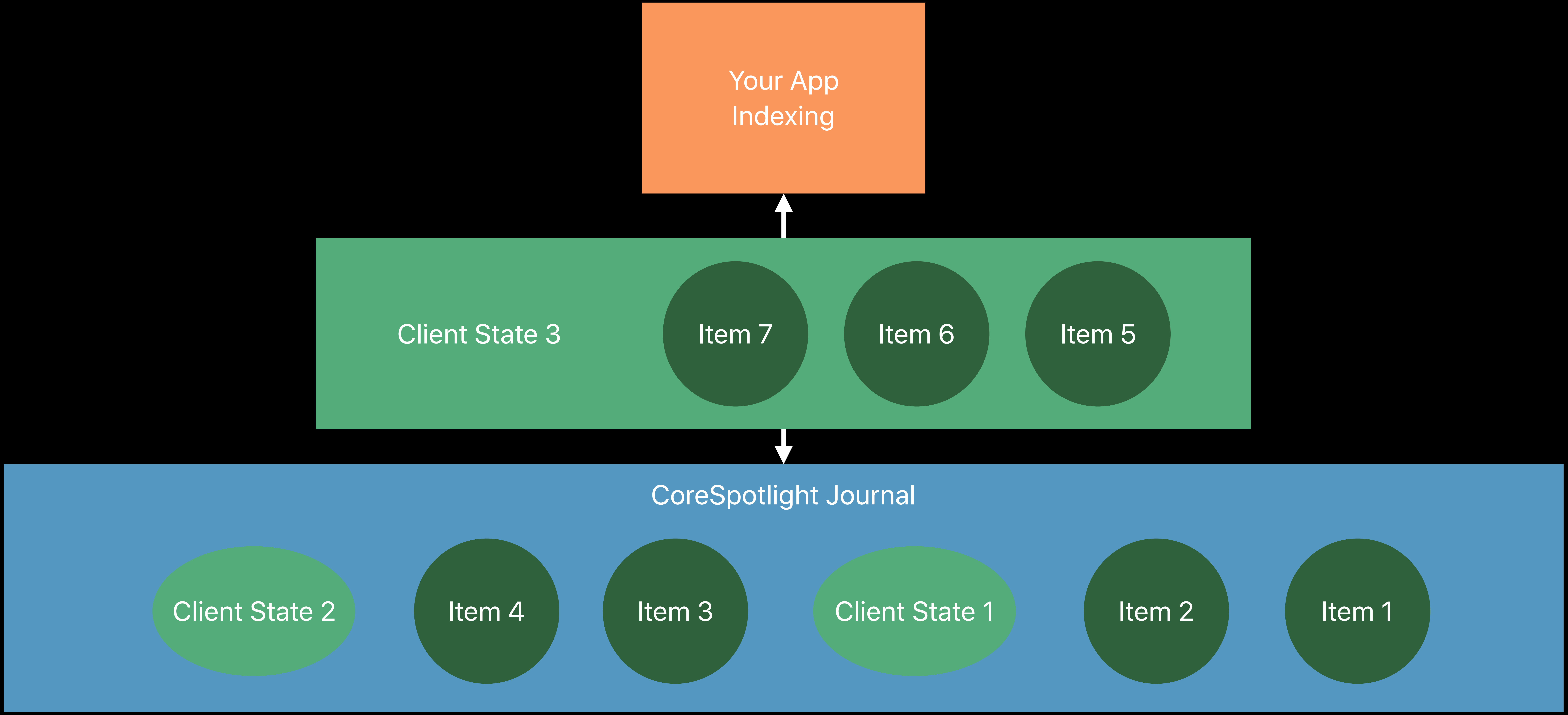
Batching and Client State

Recovery



Batching and Client State

Recovery



Setting Client State

Setting Client State

Index state uses a named index instance

Setting Client State

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- Create multiple instances if you have more than one data source

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```
let index = CSSearchableIndex(name: "myname")

index.beginBatch()

index.indexSearchableItems(items, completionHandler: nil);

let stateString = String(offset + items.count)

index.endBatch(withClientState: stateString.data(using:NSUTF8StringEncoding)!,
            completionHandler: handler)
```

Setting Client State

Index state uses a named index instance

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Checking Client State

Checking Client State

Use client state to resume interrupted indexing

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Use client state to resume interrupted indexing

Fetch and check client state when starting

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```
let index = CSSearchableIndex(name: "myname")

index.fetchLastClientState(completionHandler:  { (data, error) in
   if error != nil {
      // deal with the error!
   } else if (data != expectedData) {
      doIndex(index:index, data:data)
   }
})
```

Checking Client State

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Indexing and Performance

Indexing and Performance

Indexing is background work

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Indexing is background work

Minimize overhead

Indexing and Performance

Indexing is background work

Minimize overhead

Optimize storage and database access

Indexing and Performance

Indexing is background work

Minimize overhead

Optimize storage and database access

Use batching

Indexing and Performance

Indexing is background work

Minimize overhead

Optimize storage and database access

Use batching

- Size batches for available memory

Indexing and Performance

Indexing is background work

Minimize overhead

Optimize storage and database access

Use batching

- Size batches for available memory

Don’t block the main thread

Indexing and Performance

Indexing is background work

Minimize overhead

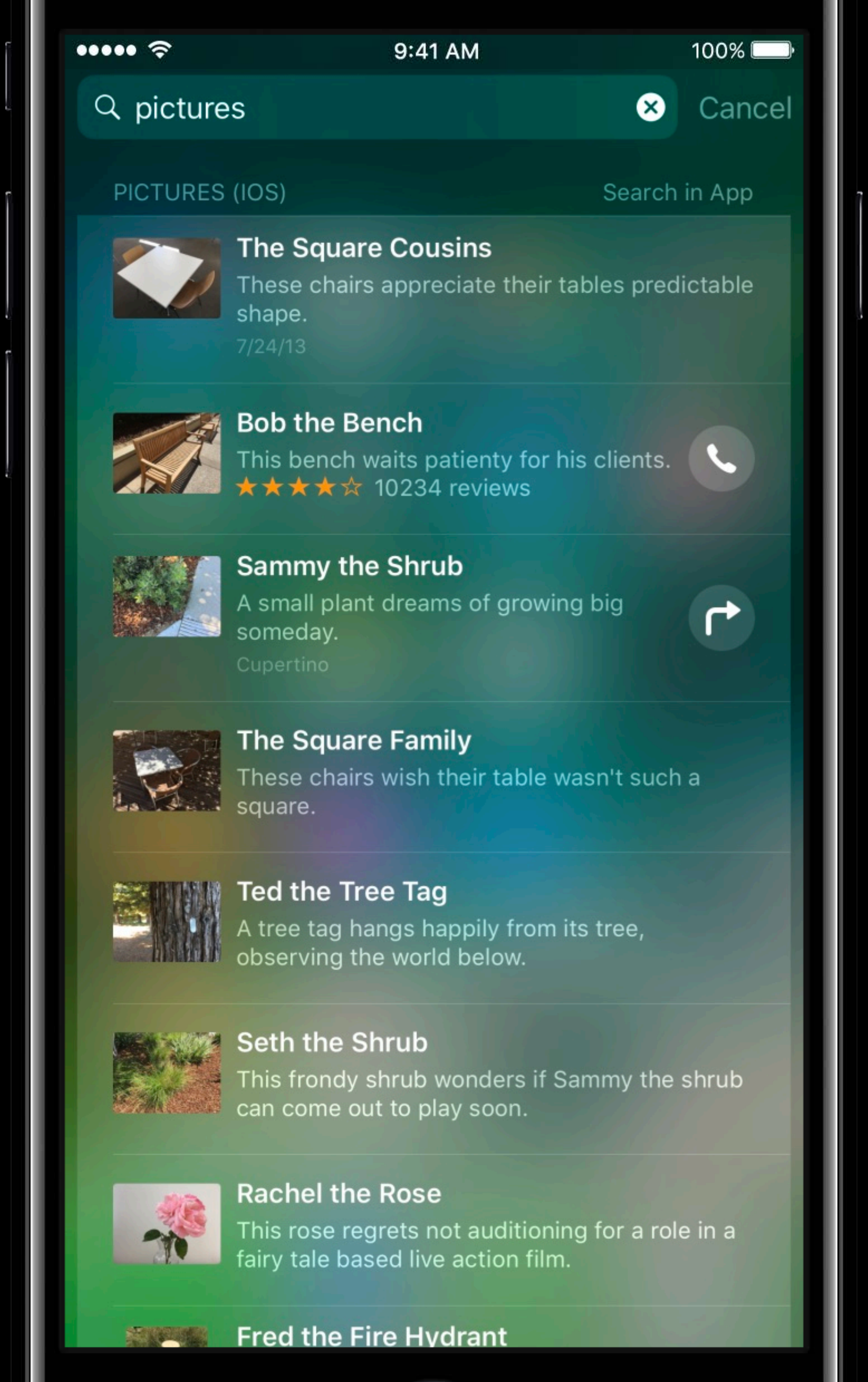
Optimize storage and database access

Use batching

- Size batches for available memory

Don’t block the main thread

Index on a background queue



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PICTURES (IOS) Search in App

The Square Cousins
These chairs appreciate their tables predictable shape.
7/24/13

Bob the Bench
This bench waits patienty for his clients.
★★★★☆ 10234 reviews

Sammy the Shrub
A small plant dreams of growing big someday.
Cupertino

The Square Family
These chairs wish their table wasn't such a square.

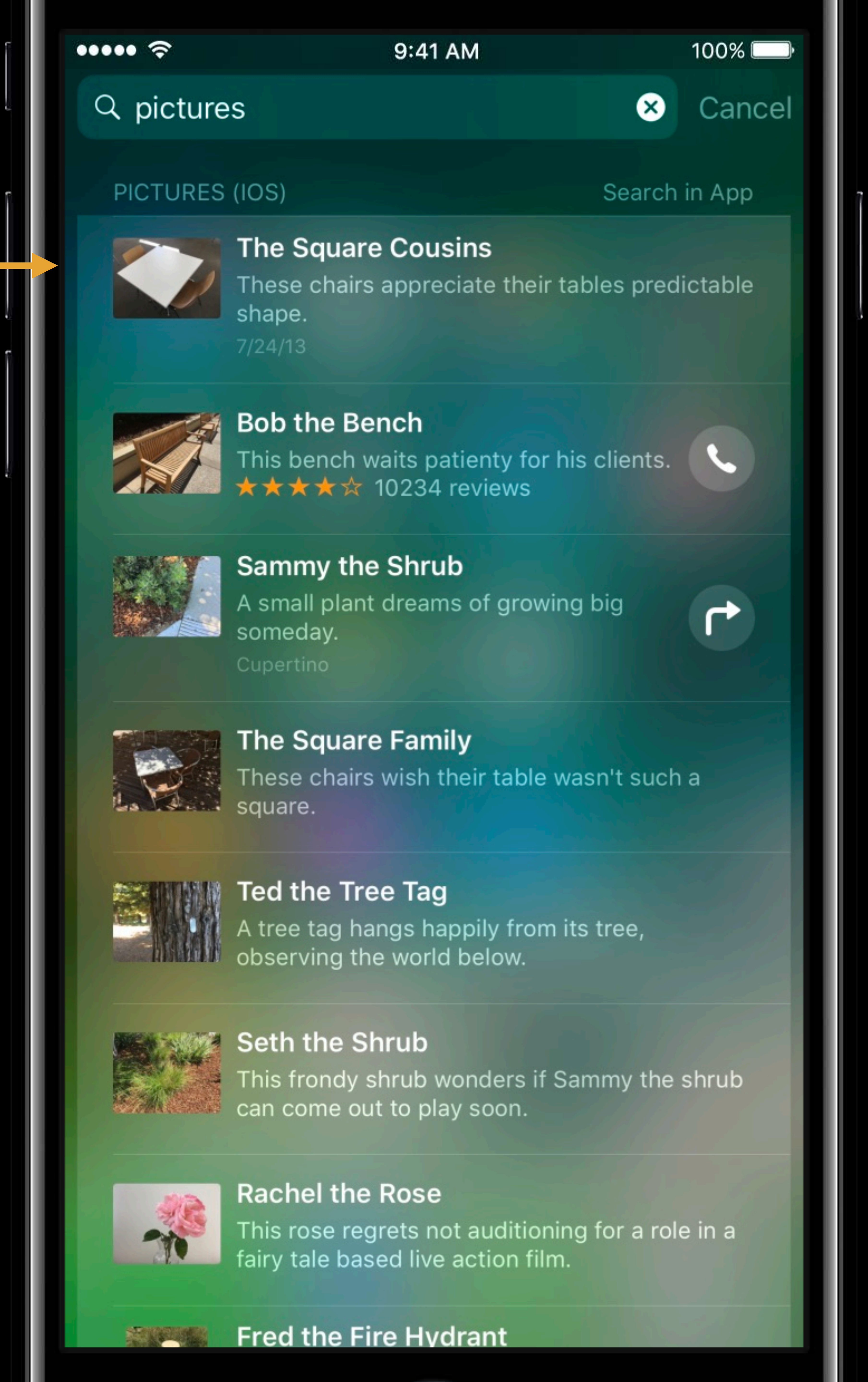
Ted the Tree Tag
A tree tag hangs happily from its tree, observing the world below.

Seth the Shrub
This frondy shrub wonders if Sammy the shrub can come out to play soon.

Rachel the Rose
This rose regrets not auditioning for a role in a fairy tale based live action film.

Fred the Fire Hydrant

thumbnailURL



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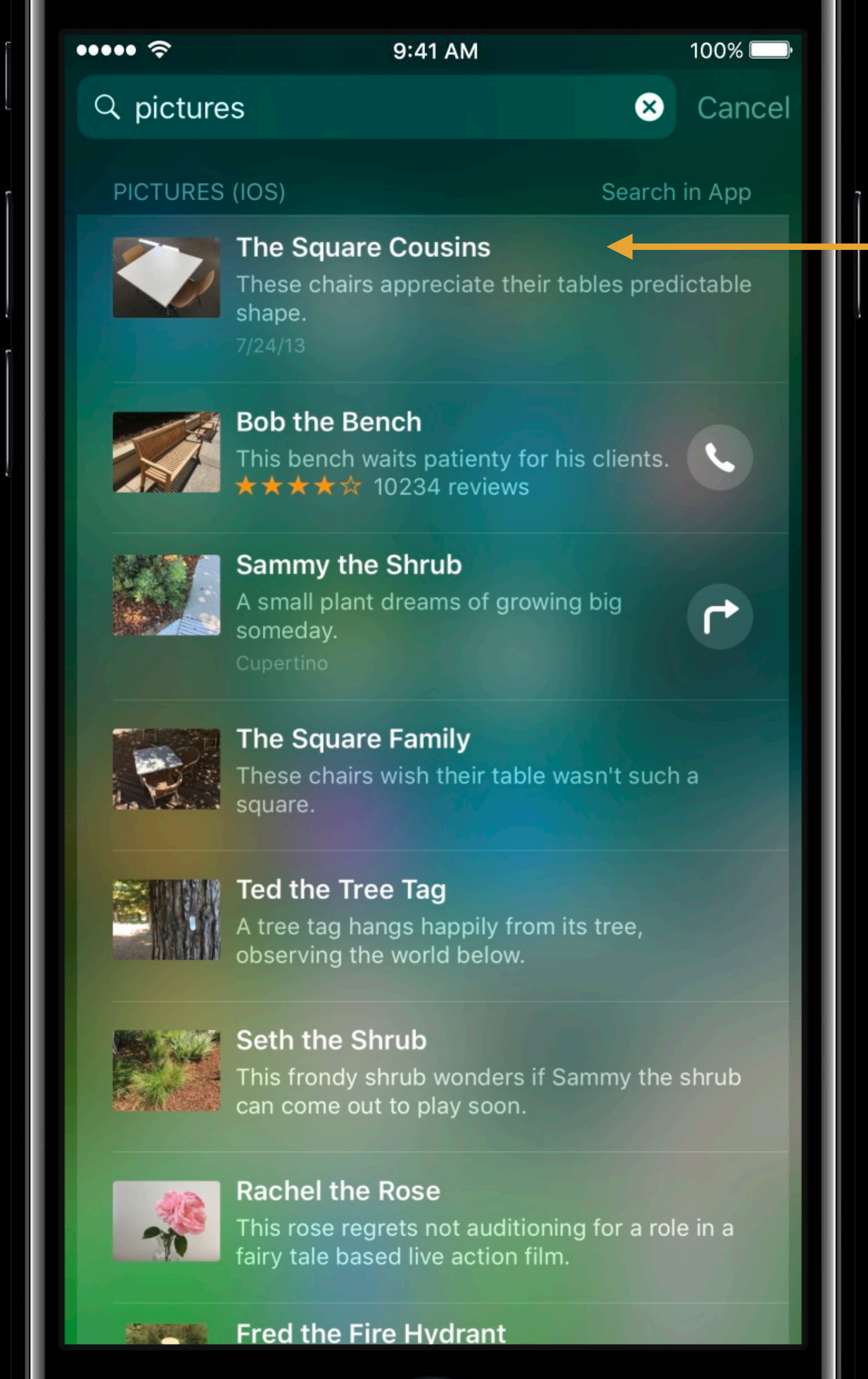

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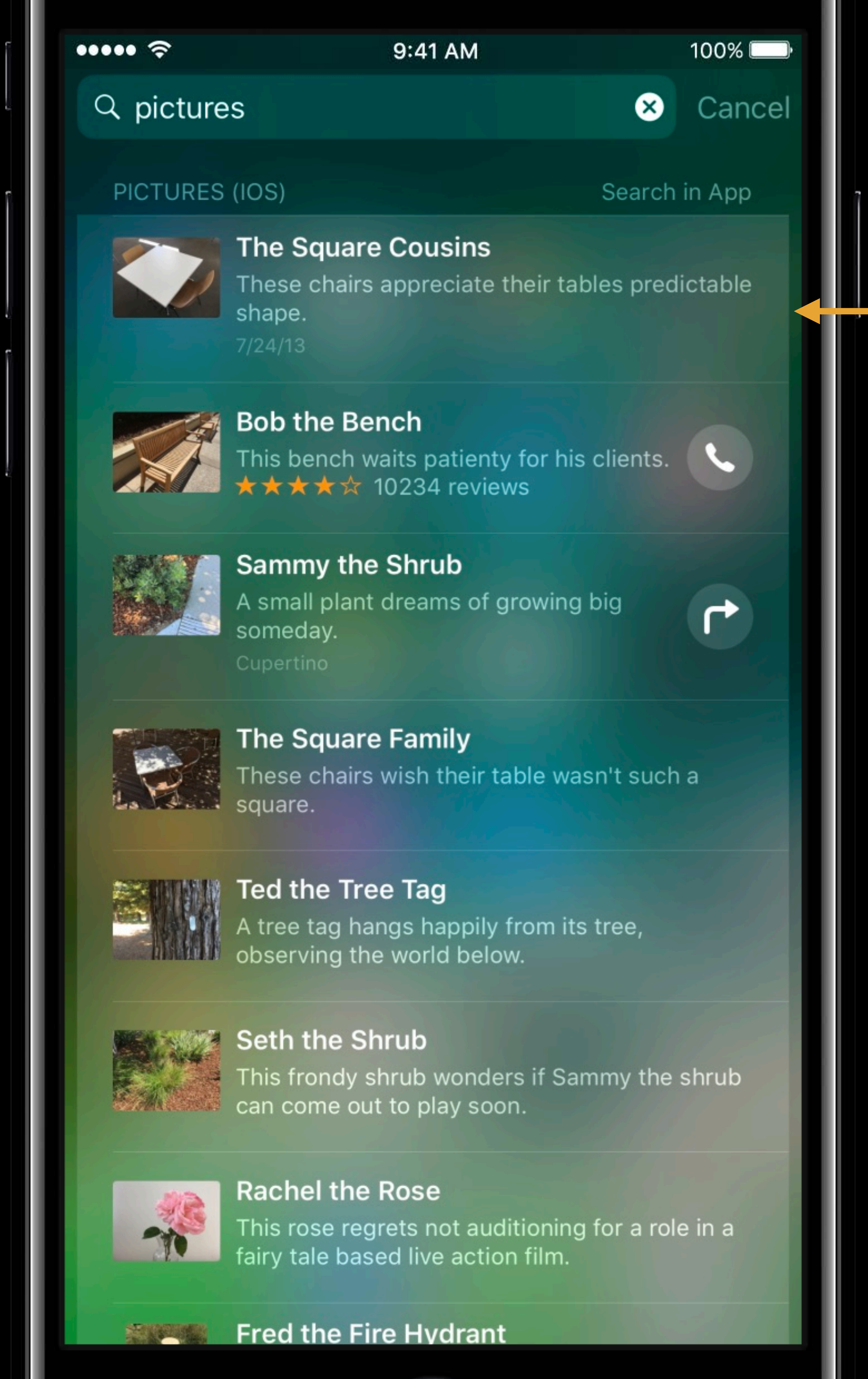
title



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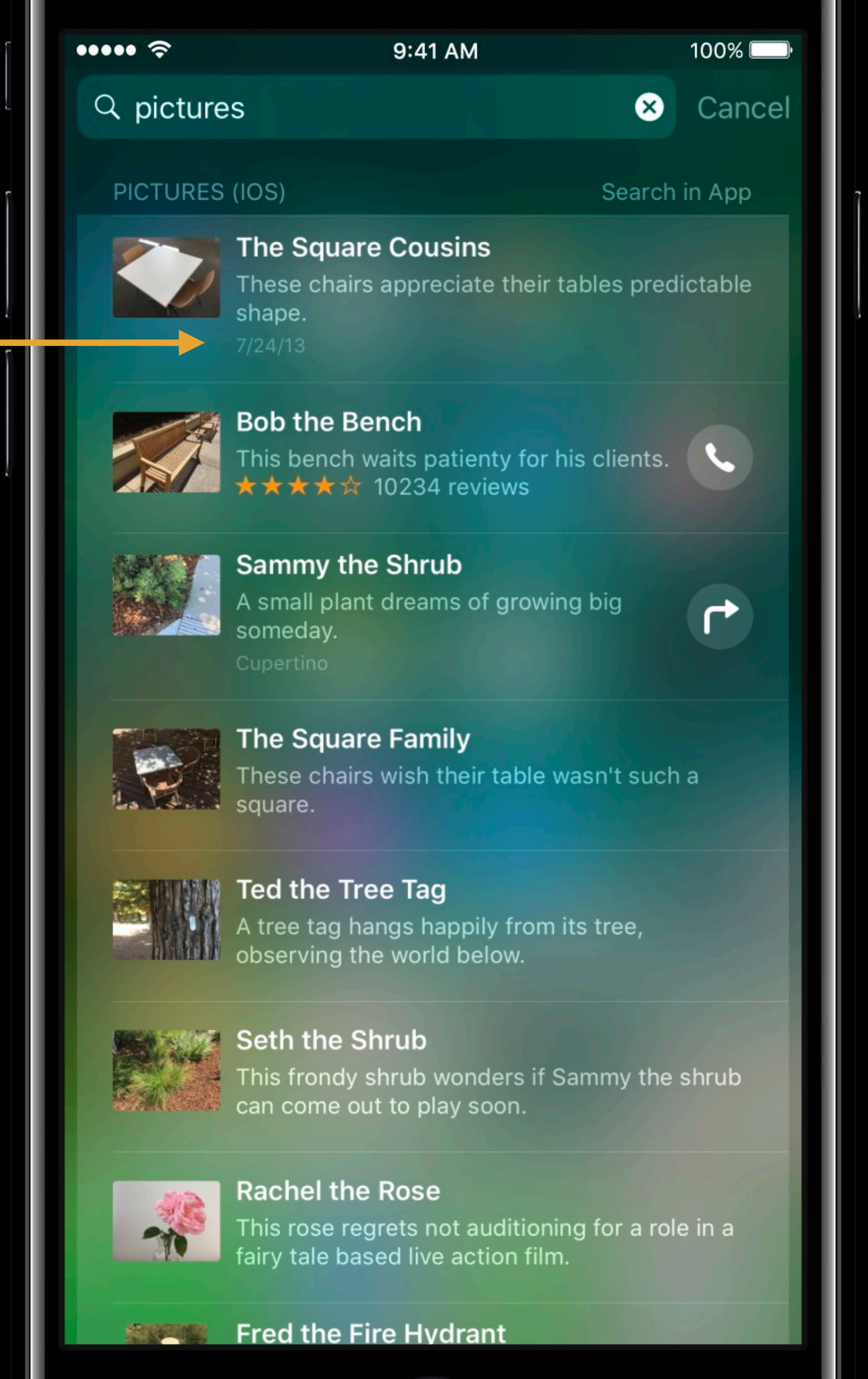
contentDescription

contentCreationDate



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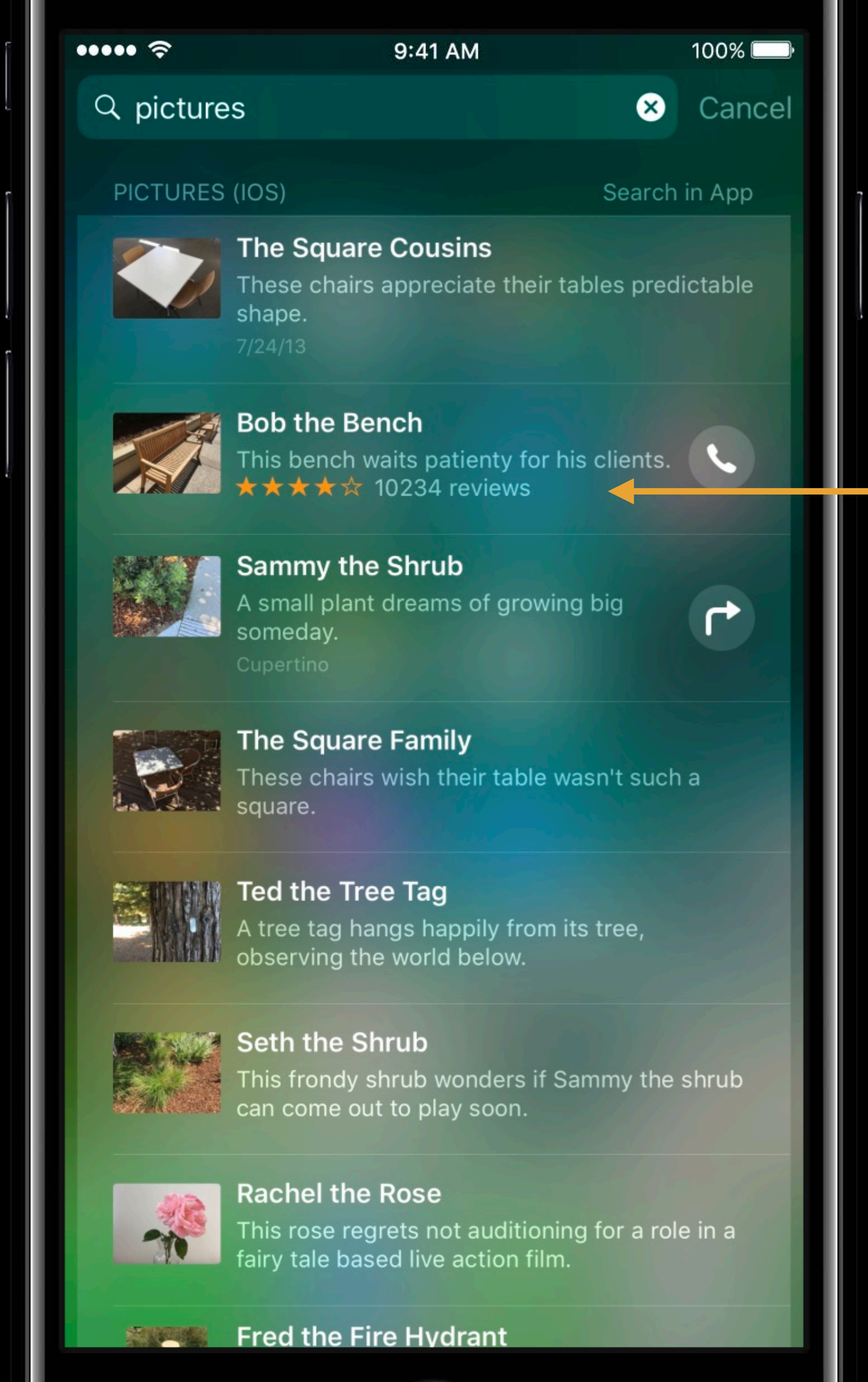

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PICTURES (IOS) Search in App

The Square Cousins
These chairs appreciate their tables predictable shape.
7/24/13

Bob the Bench
This bench waits patienty for his clients.
★★★★☆ 10234 reviews

Sammy the Shrub
A small plant dreams of growing big someday.
Cupertino

The Square Family
These chairs wish their table wasn't such a square.

Ted the Tree Tag
A tree tag hangs happily from its tree, observing the world below.

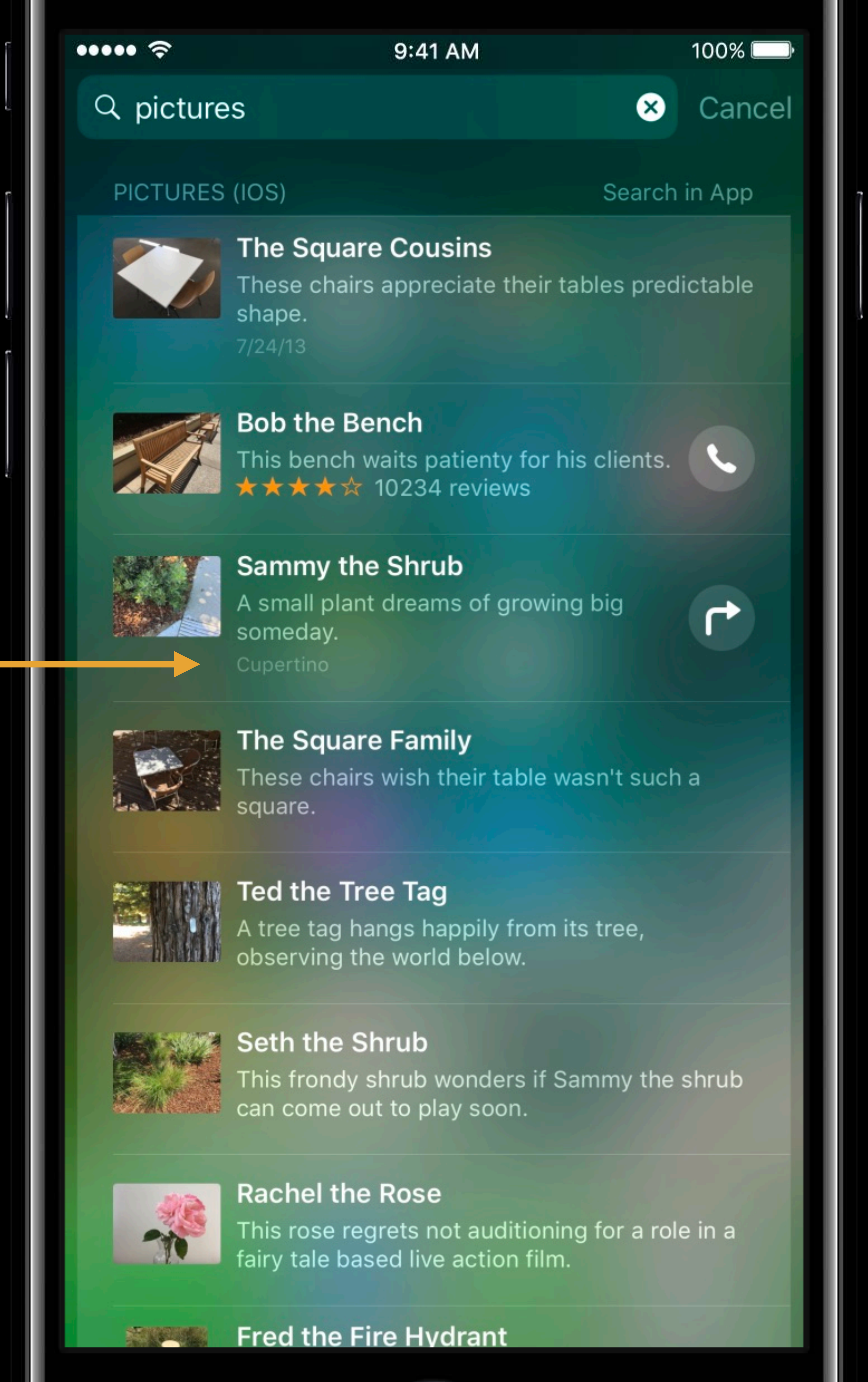
Seth the Shrub
This frondy shrub wonders if Sammy the shrub can come out to play soon.

Rachel the Rose
This rose regrets not auditioning for a role in a fairy tale based live action film.

Fred the Fire Hydrant

rating
ratingDescription

locationName



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Metadata for Display

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Set a descriptive title

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Set a descriptive title

Set a good looking, informative thumbnail

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Set the right content type for your content

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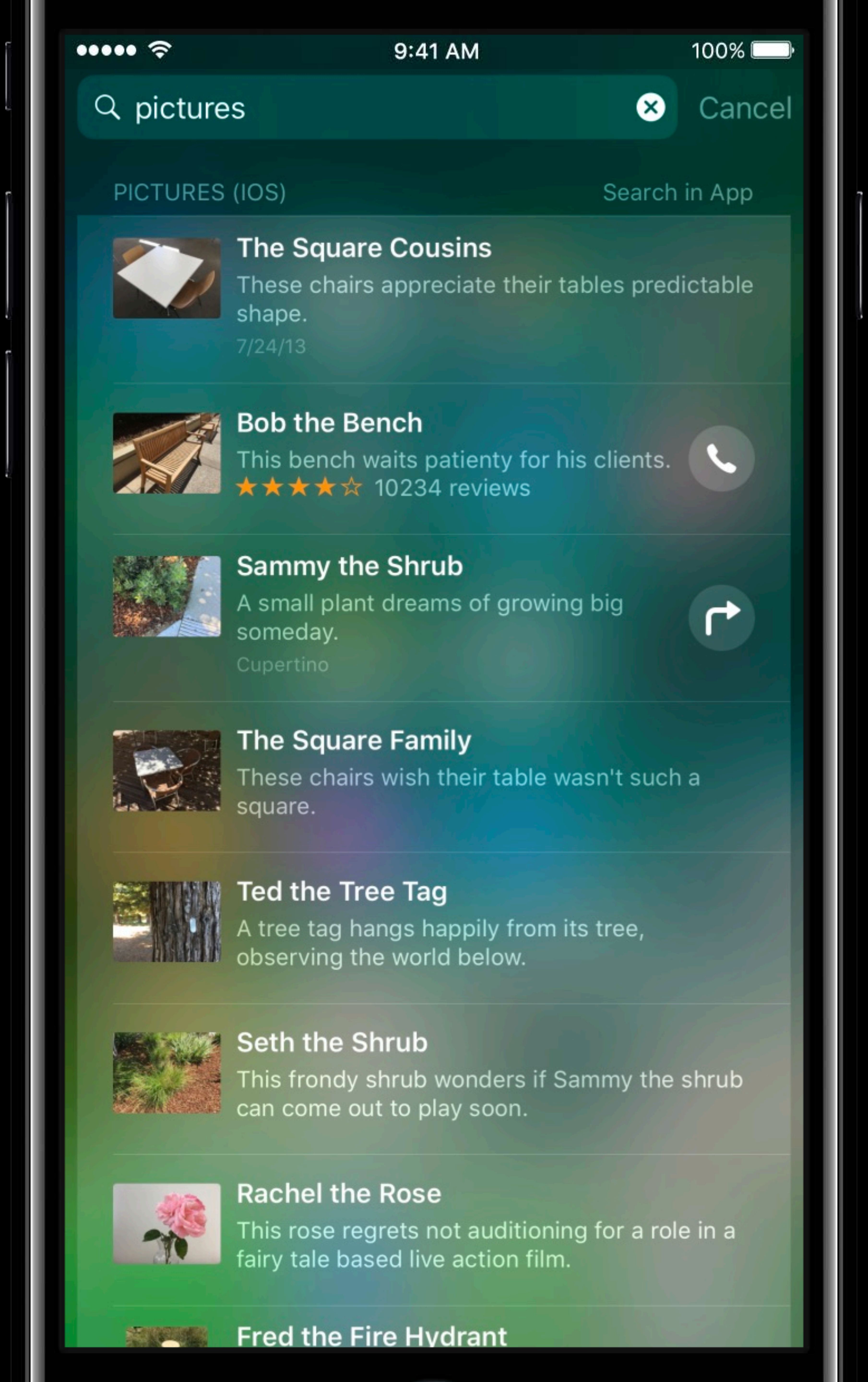
Set a good looking, informative thumbnail

Set the right content type for your content

Use attributes to fill out the UI

```
contentDescription
rating, ratingDescription
completionDate, dueDate, startDate, endDate, allDay
fileSize, pageCount
```



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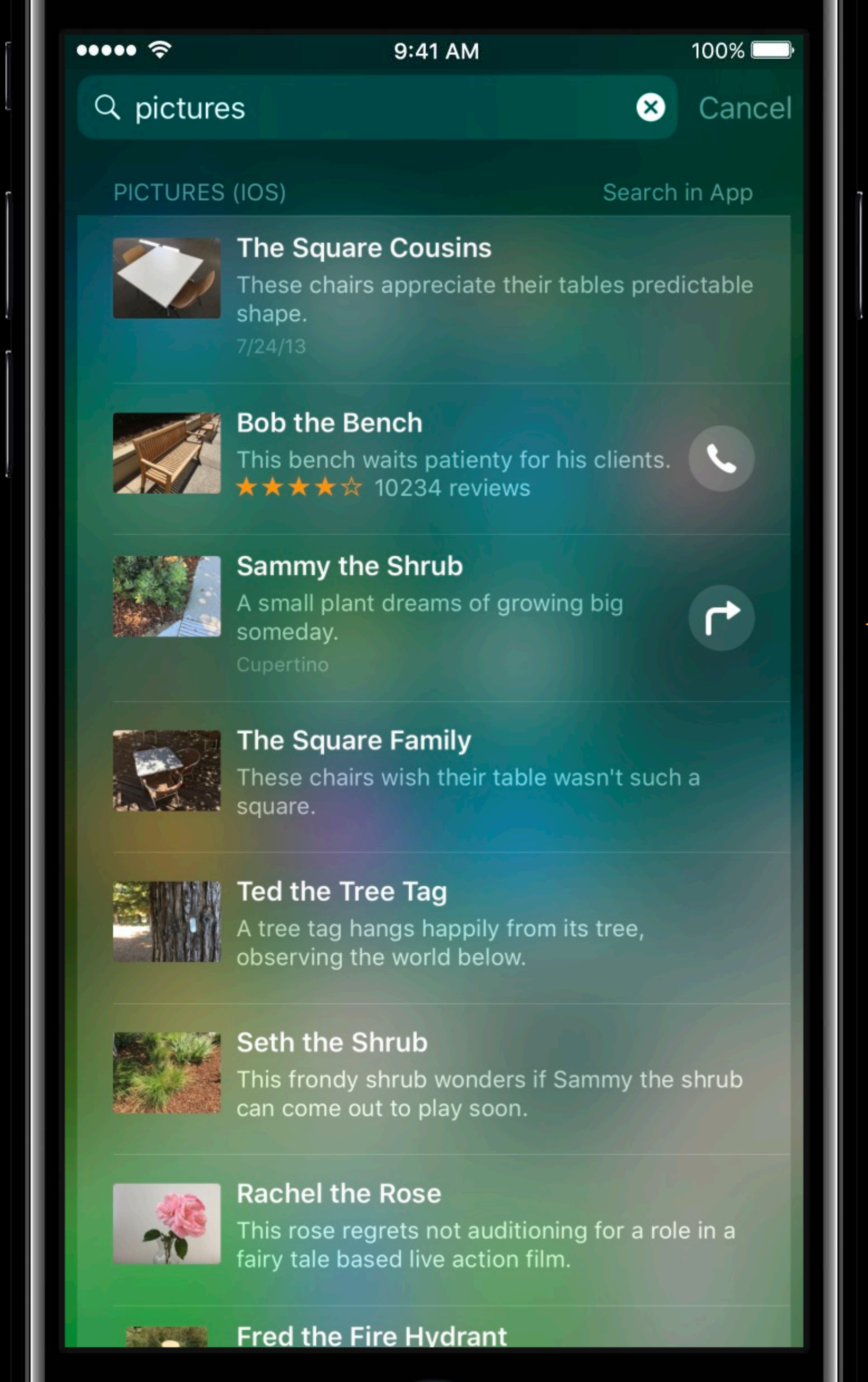

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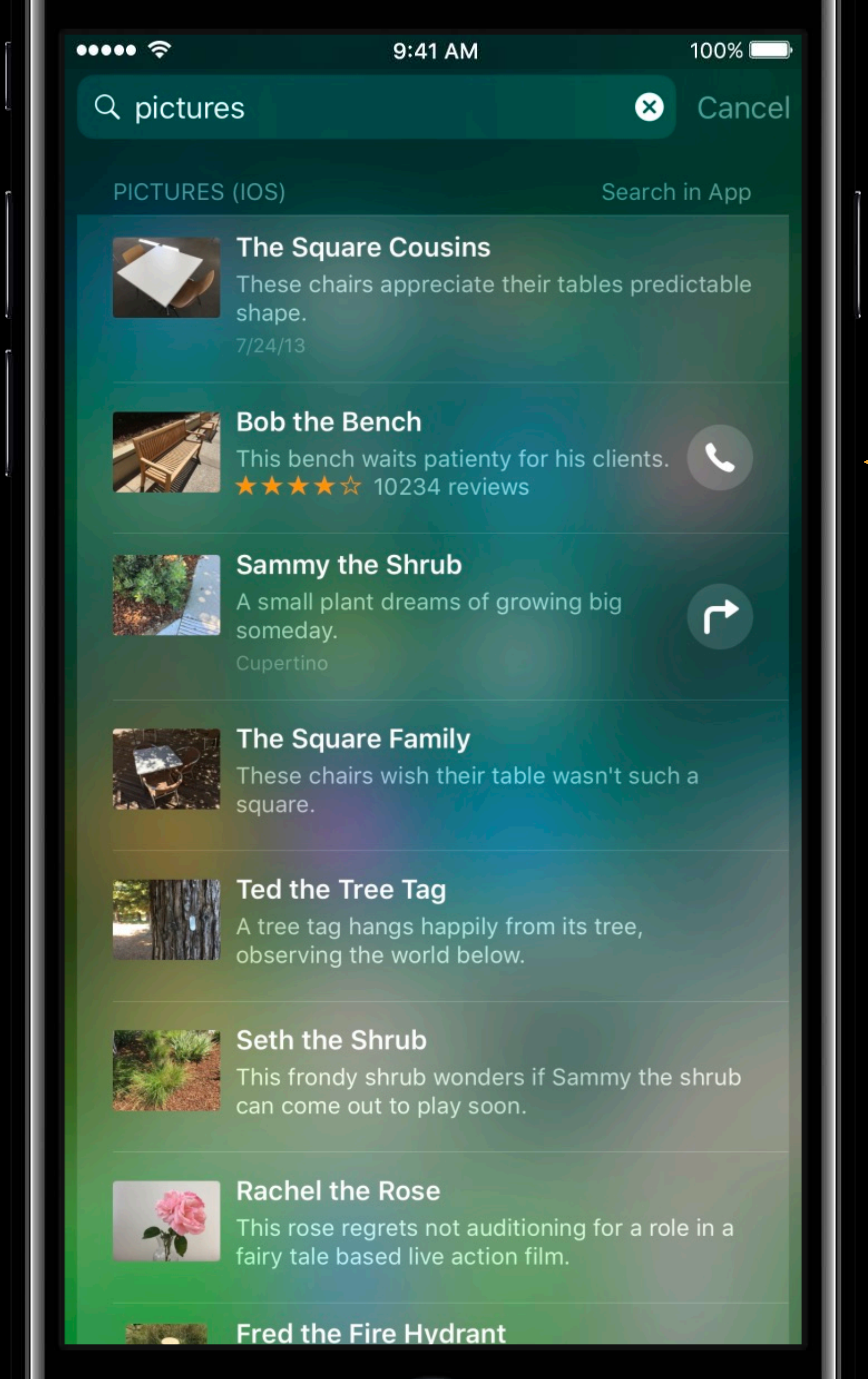
latitude
longitude
supportsNavigation



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phoneNumbers
supportsPhoneCall

Metadata for User Experience

Metadata for User Experience

Make it easy to get your content

- Set attributes the user can understand
- Keyword stuffing confuses the user and leads to poor ranking

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Set contact identifiers to support contact search

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Set contact identifiers to support contact search

Set metadata for drag and drop

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- Keyword stuffing confuses the user and leads to poor ranking

Set contact identifiers to support contact search

Set metadata for drag and drop

Provide quick actions for navigation and calls

Restoring with NSUserActivity

```
func application(application: NSApplication, continueUserActivity uA: NSUserActivity,
        restorationHandler: ([AnyObject]?) -> Void) -> Bool {
        if uA.activityType == CSSearchableItemActionType {
            if let i = uA.userInfo?[CSSearchableItemActivityIdentifier] as? String {
                // show the found item
            }
           return true
        }
       if userActivity.activityType == CSQueryContinuationActionType {
            if let searchQuery = userActivity.userInfo?[CSSearchQueryString] as? String {
                // run the search
            }
            return true
        }
        return false
}
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Searching with CoreSpotlight

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Search the data you’ve already given to Spotlight

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Same search engine that powers Spotlight, Mail, Notes, and more

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Consistent behavior with Spotlight and system apps

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Available on macOS and iOS

Using the Query Language

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```
pageCount > 10
```

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```
pageCount > 10


InRange(pageCount,10,20)
```

Using the Query Language

```
pageCount > 10

InRange(pageCount,10,20)

height > 1024 && width > 1024
```

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authors = “Johnny Appleseed”cwd || authors = “Jane Appleseed”cwd
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authors = ”Äppelfrö”cw
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Using the Query Language

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authors = ”Äppelfrö”cw

authorEmailAddresses = ”john.appleseed@apple.com"
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Using the Query Language

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authors = ”Äppelfrö”cw

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** = ”some text the user typed*”cdwt

textContent = ”phrase match”cd && * = ”blue” cwd
```

Query Syntax

Feature	Token	Example
Equality	==	keywords=“search”
Not Equal	!=	keywords!=“search”
Greater than	>, >=	pageCount > 10
Less than	<, <=	pageCount < 10
Range search	InRange	InRange(pageCount, 5, 10)
AND	&&	fileSize > 100 && pageCount > 10
OR	||	fileSize > 100 || pageCount > 10
NOT	!	!(fileSize > 100 || pageCount > 10)
Field wildcard	*	* = “search”
Field or content wildcard	**	** = “search”

String Matching

Feature	Syntax	Performance
Exact match	“search”	Fastest
Partial	“sear*h”	Fast
Prefix match	“search*”	Fast
Phrase	“johnny appleseed”	Slower
Suffix	“*rch”	Slow
Infix	“*arc*”	Slow
Infix phrase	“*johnny* *appleseed*”	Slowest

String Matching

Feature	Flag
Case insensitive	‘c’
Diacritics insensitive (ö = o, å = a, …)	‘d’
Word matching (Inc = “Apple Inc”, String = NSString)	‘w’
Tokenized (Apple Inc = Inc, … Apple)	’t'

Searching with CoreSpotlight

```
func search(userQuery :String) {
    query.cancel();
    let escapedString = escapedUserQuery(userQuery)
    let queryString = "**=\"" + escapedString + "\"cwdt"
    let newQuery = CSSearchQuery(queryString: queryString, attributes: ["displayName"])

    newQuery.foundItemsHandler =  {
        (items : [CSSearchableItem]) -> Void in
        /* process received items */
    }

    newQuery.completionHandler = {  (err) -> Void in
        /* finish processing */
        updateDisplay()
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    newQuery.start()
    query=newQuery
}
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Summary

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Provide rich metadata for search, display, and ranking

Use NSUserActivity indexing to provide usage information

Keep the index accurate and up to date

- Implement an indexing extension
- Use batching and client state for indexing

More Information

https://developer.apple.com/wwdc17/231

Related Sessions

Introducing Drag and Drop	WWDC 2017
Privacy and Your Apps	WWDC 2017
What’s New in CoreData	WWDC 2017
Mastering Drag and Drop	WWDC 2017
Building Great Document-based Apps in iOS 11	WWDC 2017

Labs

Core Data Lab	Technology Lab H	Thu 4:10PM–6:00PM
Core Spotlight and Search Lab	Technology Lab H	Fri 9:00AM–11:00AM

WWDC17