

Making the Most of Search APIs

New features and updates expand search capabilities

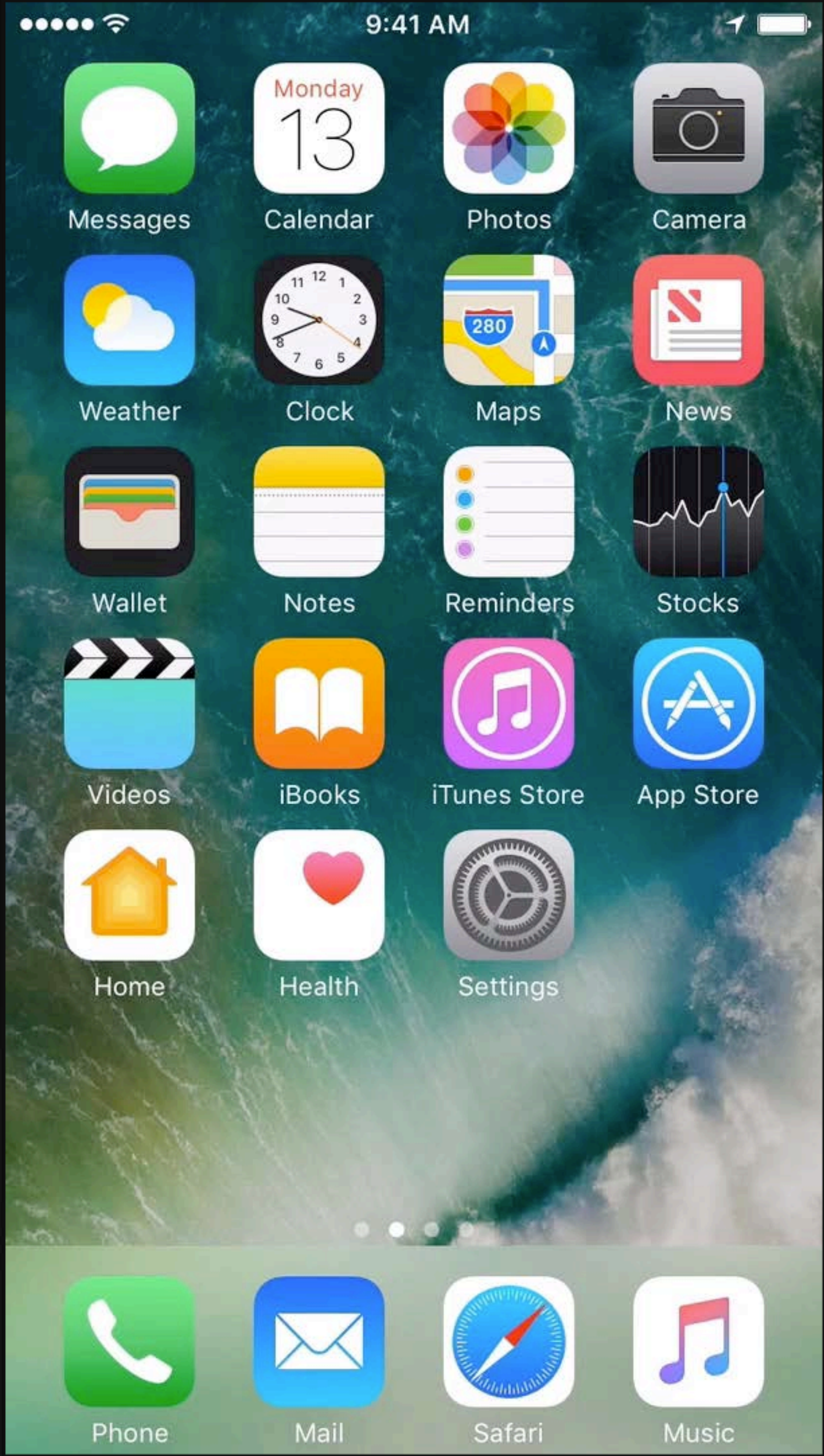
Session 223

Vipul Ved Prakash Apple, Inc.

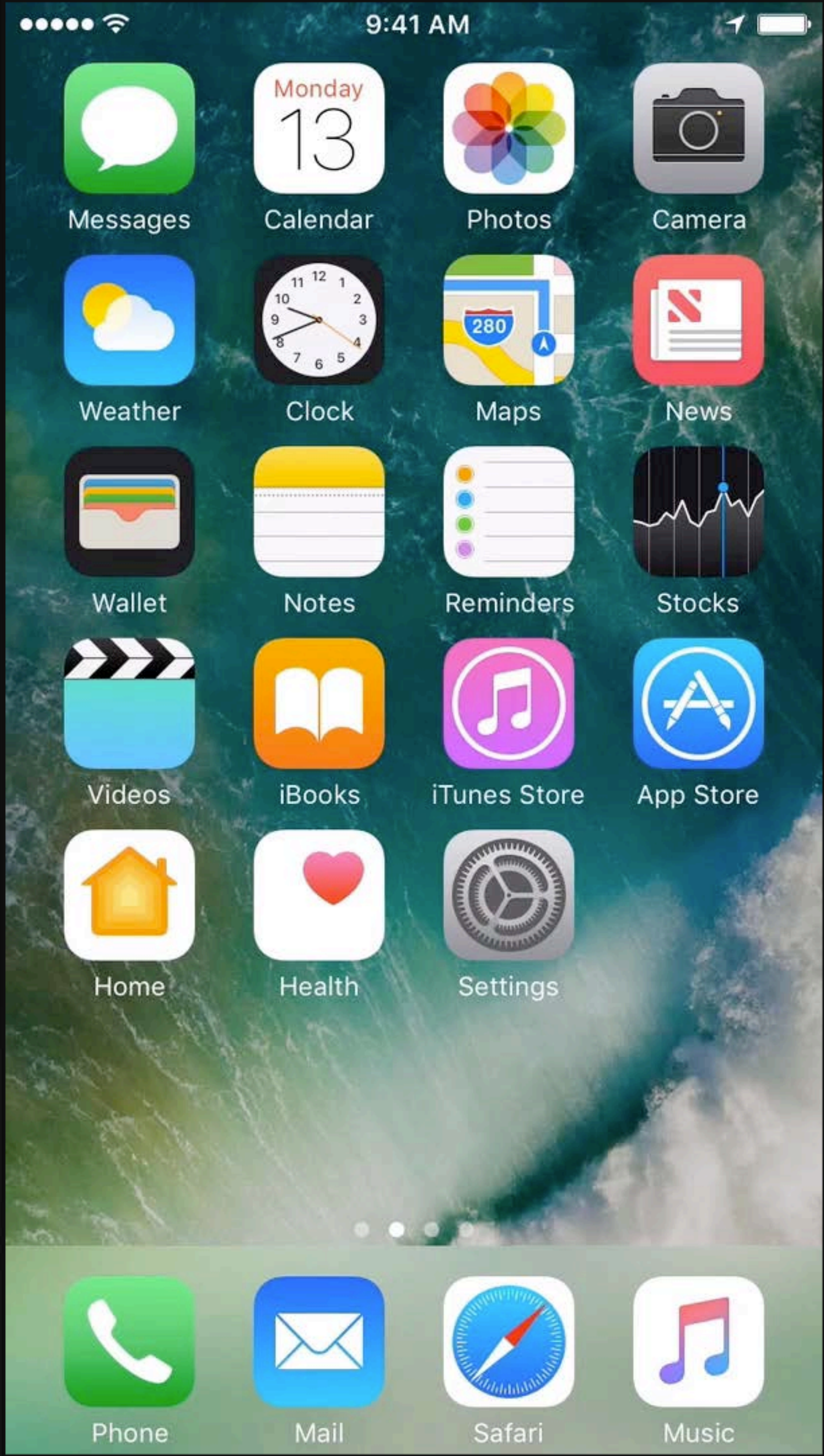
John Hörnkvist Apple, Inc.

Spotlight Updates in iOS 10

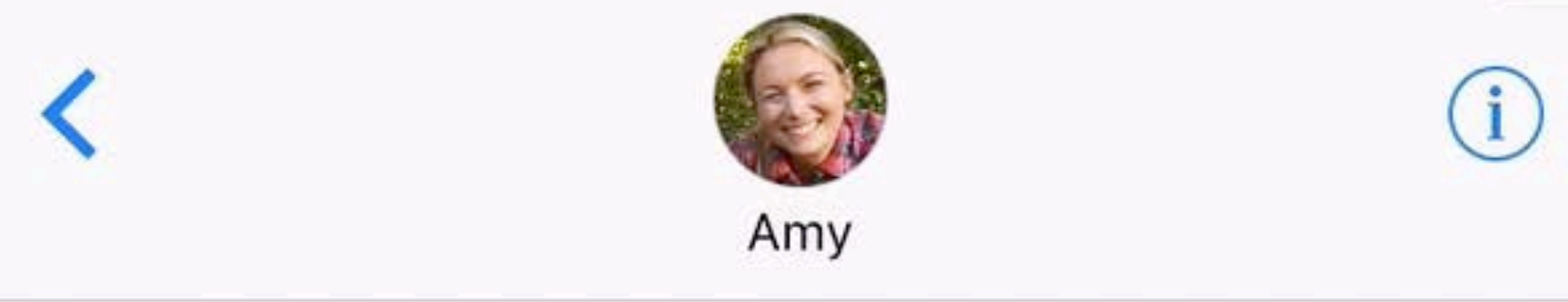
Notification Center



NEW



NEW



Text Message
Today 9:41 AM

I'm at the store. What do we need for lettuce wraps?

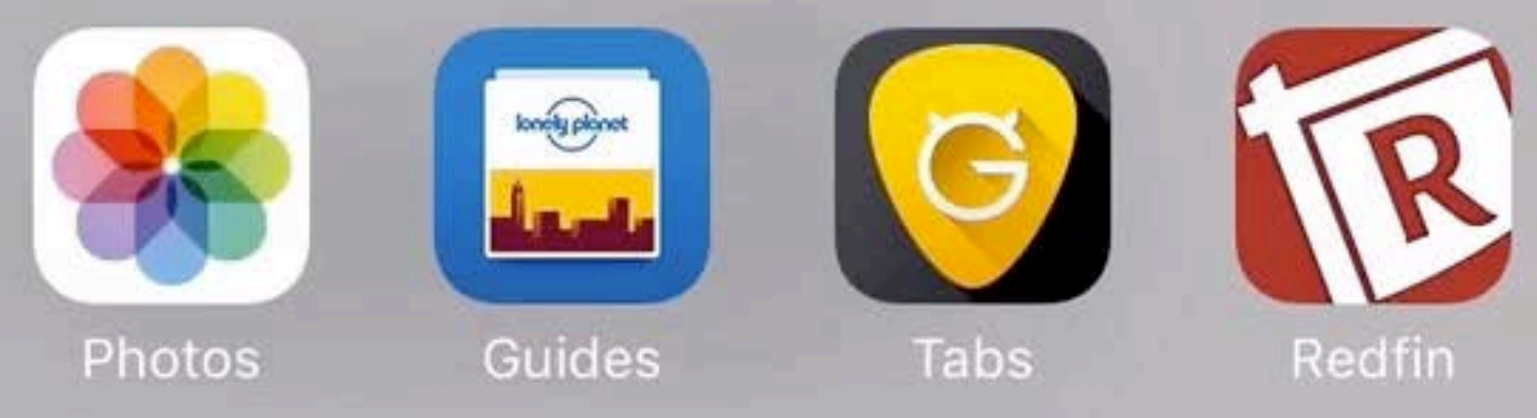
> Text Message ↑



NEW

Search Cancel

SIRI SUGGESTIONS Show More



san francisco

strand theater

banjo tuner

giants

maui 2



NEW

NEW

This easy appetizer is packed with flavor and crunch and comes together in less than half an hour that means less time in the kitchen and more time enjoying long summer evenings! Spoon the mixture into halved mini sweet peppers to serve it as a festive party dish.

★★★★☆ | 3



0



0

NUTRITIONAL INFORMATION

Per Serving: 230 calories (70 from fat), 7g total fat, 65mg cholesterol, 530mg sodium, 33g carbohydrate (2g dietary fiber, 3g sugar), 8g protein

INGREDIENTS

- + 1 **box** 365 Everyday Value® frozen Lightly Breaded Calamari

- + 2 **teaspoons** expeller-pressed canola oil

- + 1/2 **pound** (8 ounces) green beans, thinly sliced

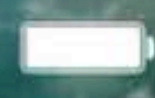
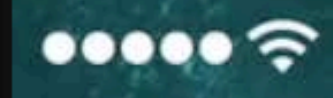
- + 1/2 **package** frozen Whole Foods Market Vegetable Fried Rice

Spotlight Updates in iOS 10

Notification Center

Search on Lock Screen

3D Touch

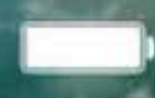
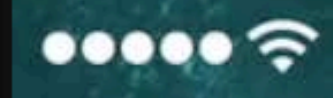


9:41

Monday, June 13

Confidential & Proprietary. Call +1 877-595-1125





9:41

Monday, June 13

Confidential & Proprietary Call +1 877-595-1125

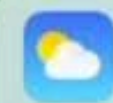




Search

9:41

Monday, June 13



WEATHER

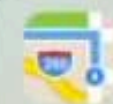
Show More



Santa Clara

Partly Cloudy
Chance of Rain: 0%

61°
75° / 53°



MAPS NEARBY



Breakfast



Coffee



Convenien...



Gas



STOCKS

Show More

DOW J

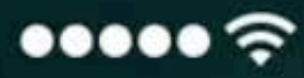
17,732.48

-132.86

NASDAQ

4,848.44

- 46.11



9:41 AM



Q Search

Cancel

Q stephen curry

Q warriors

Q mascone center

Q san francisco

Q hotels

q w e r t y u i o p

a s d f g h j k l

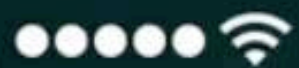
⏪ z x c v b n m ⏩

123



space

return



9:41 AM



Q stephen curry



Cancel

SPORTS



Stephen Curry

#30, Point Guard, Golden State Warri...
6' 3", 190 lb

NBA



WIKIPEDIA

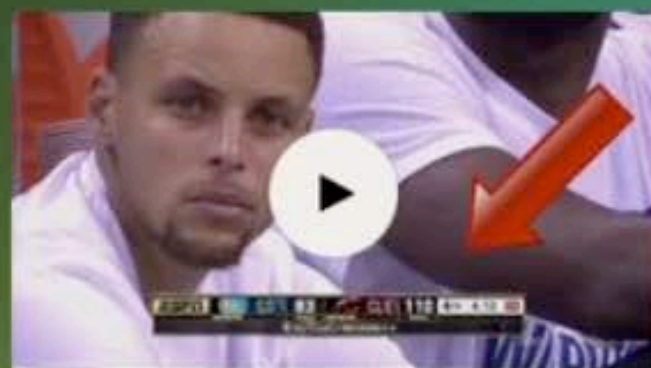


Stephen Curry

Wardell Stephen "Steph" Curry II (born March 14, 1988) is an American professional basketball player for the...



WEB VIDEOS



Stephen Curry Is The Worst MVP To Ever Play...

by CashNastyGaming
6/8/2016 • 8.5K views

YouTube



I GOT INTO A BLOODY FIGHT WITH STEPHEN...

by CashNastyGaming
6/7/2016 • 31K views

YouTube

Spotlight Updates in iOS 10

Notification Center

Search on Lock Screen

3D Touch

Query Suggestions

Q banjo ✕ Cancel

APP STORE

Search in App



Banjo Tuner: Tuner For Banjo Plus Banjo Chords...

By Bradley Hilton
★★★★☆ (8)

VIEW



Banjo Tuner

By Alvin Yu
★★★★☆ (9)

VIEW



Tuner+

By Nick Culbertson
★★★★★ (30)

VIEW

WIKIPEDIA

banjo tuner

banjo chords

q w e r t y u i o p

a s d f g h j k l

⏪ z x c v b n m ⏩

123 😊 🗣️ space return

Search APIs Released in iOS 9

Three technologies for implementing search

Search APIs Released in iOS 9

Three technologies for implementing search



CoreSpotlight

Any App Content

Search APIs Released in iOS 9

Three technologies for implementing search



CoreSpotlight

A large orange circle containing the text 'CoreSpotlight'.

Any App Content



NSUserActivity

A large green circle containing the text 'NSUserActivity'.

Viewed App Content

Search APIs Released in iOS 9

Three technologies for implementing search



CoreSpotlight

Any App Content



NSUserActivity

Viewed App Content



Universal Links

App Content on Web

50,000+

Apps using Search APIs

Q maui  Cancel

MAIL

Search in App

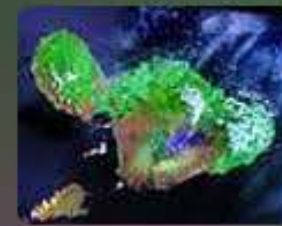



Kayak Travel Services 6/3/16, 4:58 PM
Flight Reservation #20053423
Thank you for booking your trip to Maui, HI with Kayak.com. Login, See Services, Touring...



OpenTable 6/3/16, 4:56 PM
Reservation Confirmation
Thank you for booking your trip to Maui, HI with Kayak.com. Login, See Services, Touring...

WIKIPEDIA



Maui
The island of Maui is the second largest of the Hawaiian Islands at 727.2 square miles and is the 17th largest of the Hawaiian... 

MAPS



Kahului Airport
Regional Airport
★★★★★ (468) on Yelp 

Search Web

Search App Store

Q maui

Cancel

KAYAK



Maui Trip

Sat, June 18 - Sat, June 25, 2016

HOTEL TONIGHT



Aston Kaanapali Villas, Maui

Saturday, June 18 - Friday June 24, 2016
45 Kai Ala Drive, Maui, HI

OPENTABLE



Gerard's Restaurant Maui

Table for 2 people Saturday, June 18
at 7:15 PM



Honu's on the Beach
Restaurant

Table for 2 people Tuesday, June 21
at 7:30 PM



PINTEREST



Top 20 Activities in Maui

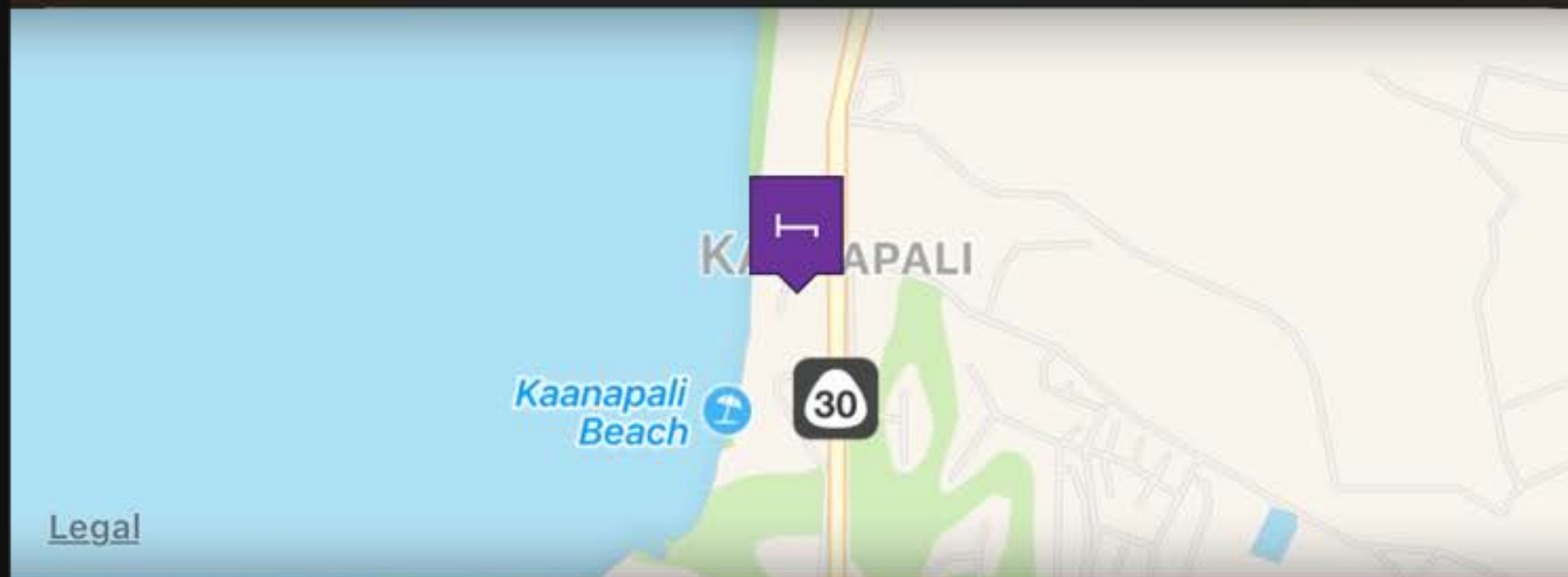
XaRen • Unsorted - Maui



Hey, Vipul!
Hope you're looking forward to your visit!

Aston Kaanapali Villas

45 Kaai Ala Drive, Maui, HI
Sat June 18 - Fri June 24



Forecast: Some ☁

80°F | 69°F

Why We Like It

Close to a wealth of outdoor adventure – hiking on hills, whale watching on a catamaran, snorkeling among the maritime fauna, all nearby.

Check-in

Sat June 18, 2016

3:00 PM

☀ 111°F | 79°F

Check-out

Fri June 24, 2016

12:00 PM

☀ 105°F | 75°F





9:41 AM



maui

Cancel

KAYAK



Maui Trip

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PINTEREST



Top 20 Activities in Maui

XaRen • Unsorted - Maui



Gerard's Restaurant Maui



Gerard's Restaurant Maui



2 people



Fri, June 18



7:15 PM

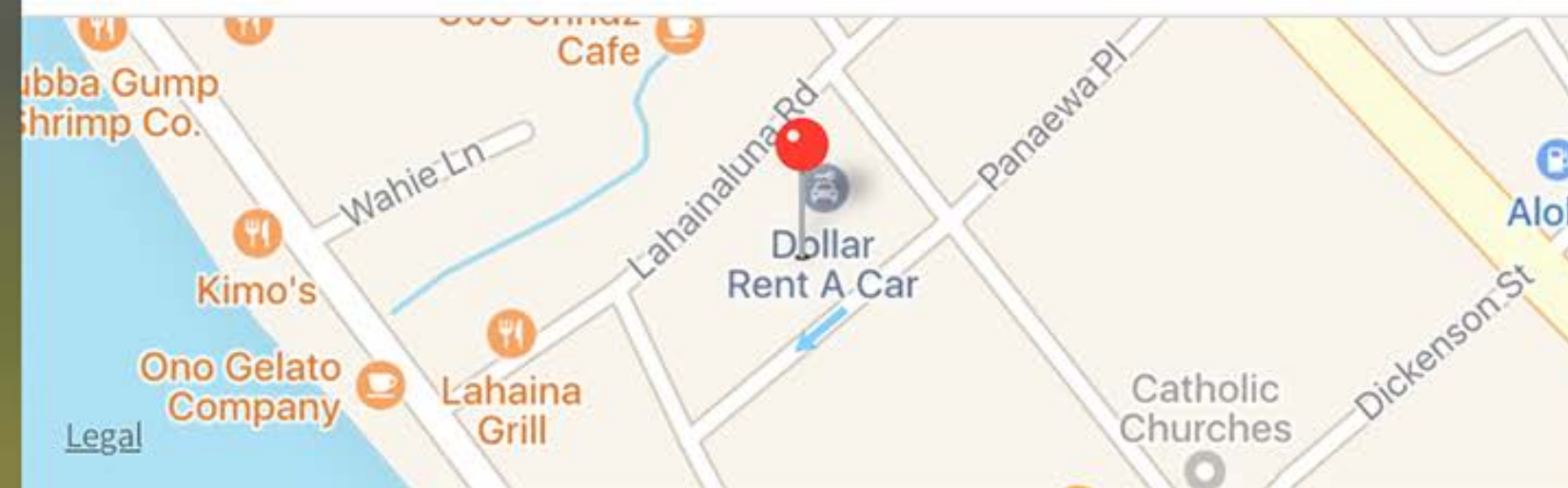
Cancel

Change

Call

Map

174 Lahainaluna Rd, Lahaina, HI 96761



[Open in Maps](#)

Menu

maui

Cancel

KAYAK



Maui Trip

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PINTEREST



Top 20 Activities in Maui

XaRen • Unsorted - Maui



9:41 AM



Q maui

Cancel

KAYAK



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PINTEREST



Top 20 Activities in Maui

XaRen • Unsorted - Maui

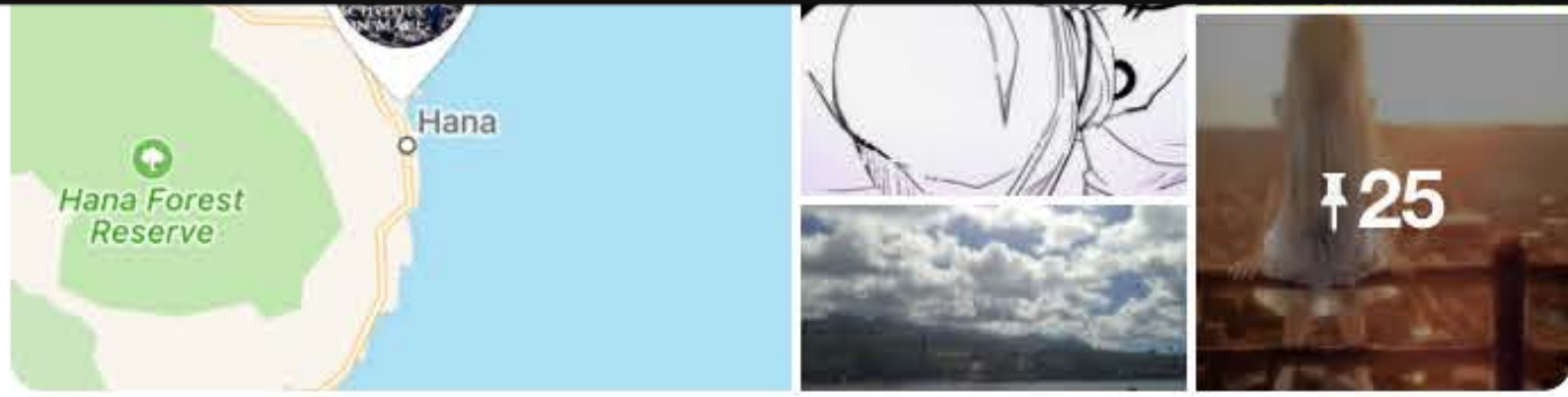


Saved from www.prideofmaui.com

Visit

About City of Hana, HI





20 Best Activities #Maui has to offer! 1y



Kate Johnson



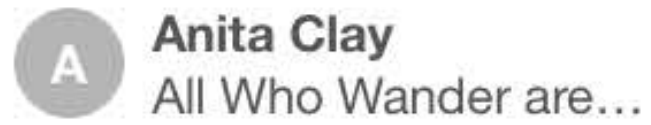
Saved to Oh, the places you'll go...

Add a comment 1



10 of Hawaii's Best Hidden Beaches 11

msn.com



Anita Clay
All Who Wander are...



The 3 Most Awe-Inspiring Hikes in Maui 21

The Huffington Post



Heather Grause
Aloha



Content Your Users Want to Get Back To

Order confirmations

Upcoming events

Tickets

Reservations

Deliveries



9:41 AM

100%

Q allen buchinski Cancel

TOP HITS



Allen Buchinski
Contacts



YAHOO MAIL



Allen Buchinski
Hi Vipul! Hope all is well with you. I am coming home from London and was wondering if you...

SKYPE



Allen Buchinski
allenbuchinski

WHATSAPP



Allen Buchinski
Hi Vipul
Today at 9:22 AM



Allen Buchinski
Hope you are doing great!
Today at 9:24 AM

< Back

Pick up from airport?



Allen Buchinski

to Vipul Prakash

May 20, 2016 at 3:49 PM

Hi Vipul!

Hope all is well with you. I am coming home from London and was wondering if you might be able to pick me up from the airport? My flight lands at 1:20pm in SFO. Flight is United Airlines 900.

Had a great time, but looking forward to getting home. Hope you enjoy the photo below. BTW my phone number is now [\(415\) 555-9552](tel:4155559552).

Thanks!
Allen





9:41 AM

100%

Q allen buchinski Cancel

TOP HITS



Allen
Buchinski
Contacts



YAHOO MAIL



Allen Buchinski
Hi Vipul! Hope all is well with you. I am coming home from London and was wondering if you...

SKYPE



Allen Buchinski
allenbuchinski

WHATSAPP



Allen Buchinski
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Allen Buchinski
Hope you are doing great!
Today at 9:24 AM



Today

Hi Vipul 9:22 AM ✓

Hope you are doing great!
9:24 AM ✓



Enhance Native Spotlight Content

Enhance Native Spotlight Content

Instant answers

Sports

Web search

Music

Contacts

Locations

Apps

TV

Stocks

Weather

Calculations

Movies

🔍 how to do cpr ✕ Cancel

SUGGESTED WEBSITE



American Red Cross - CPR Steps

Cardiopulmonary resuscitation (CPR) can help save a life during a cardiac or breathing emer...

<http://www.redcross.org/take-a-class/cpr/perfo...>



First Aid | How To Do CPR

There is no substitute for learning cardiopulmonary resuscitation (CPR), but eme...

<https://www.verywell.com/how-to-do-cpr-1298...>

WEB VIDEOS



How to Perform CPR

by CPRCertified.com

Uploaded 2/10/2015 • 28M views

YouTube

WIKIHOW



How to Do CPR on an Adult

Knowing how to perform both methods of CPR (cardiopulmonary resuscitation) on an adult could save a life. However, the recommended...



How to Do CPR on a Baby

Though CPR (cardiopulmonary resuscitation) should be administered by individuals trained at a certified first aid course, normal bystanders c...

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How to Do CPR on a Baby

Though CPR (cardiopulmonary resuscitation) should be administered by individuals trained at a certified first aid course, normal bystanders c...



How to Perform Self CPR

CPR (cardiopulmonary resuscitation) is a lifesaving technique that's useful in many emergency situations, such as heart attacks...

Search Web

Search App Store

Search Maps

How to Do CPR on an Adult

In 2010, the American Heart Association made a radical change to the recommended CPR process for victims of cardiac arrest[1] after studies showed that compression-only CPR (no mouth-to-mouth breathing) is as effective as the traditional approach. Here's how to perform both methods of CPR on an adult.

Method One of Four Taking Vitals



1 Check the scene for immediate

What's New

New in iOS 10

NEW

What's New

New in iOS 10

NEW

Search in App

CoreSpotlight Search API

Differential Privacy

Visual Preview in Web Markup Tool



9:41 AM



Q trip



Cancel

MAIL

Search in App



Katie Ables

2/21/16, 9:07 AM

Trip to San Francisco

Vipul, Visiting you in San Francisco was so much fun. We definitely need to head back...



Ethan Izzarelli

2/15/16, 12:22 AM

Surfing Trip

Hey Vipul, Our surfing trip to Hawaii was incredible. We stayed on the north shore...



Derek Parker

2/3/16, 7:07 PM

Australia Trip

Hi Vipul, Our family vacation to Australia was incredible. We visited Sydney, Brisbane...

PINTEREST



Trips around the world

Sanaa Lathan I love travel. These are dream images. 569 Pins

WIKIHOW



How to Plan a Backpacking Trip

With a little effort, backpacking trips can be serious fun. A well-planned trip will all...

Search Web

NEW

trip Cancel

NEW

MAIL Search in App

- Katie Ables** 2/21/16, 9:07 AM
Trip to San Francisco
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WIKIHOW

How to Plan a Backpacking Trip
With a little effort, backpacking trips can be serious fun. A well-planned trip will all...

Search Web

Users can continue their Search in the App





9:41 AM

100%

🔍 Trip



Cancel

All Mailboxes

Current Mailbox

John Baily 5/21/16 >

Yosemite Trip

Hey Vipul, We're getting excited for our trip to Yosemite this summer. The kids are going to h...

Katie Abeles 5/20/16 >

Trip to San Francisco

Vipul, Visiting you in San Francisco was so much fun. We definitely need to head back soon. Her...

Derek Parker 5/3/16 >

Australia Trip

Hi Vipul, Our family vacation to Australia was incredible. We visited Sydney, Brisbane, and M...

Ethan Izzarelli 4/22/16 >

Surfing Trip

Hey Vipul, Our surfing trip to Hawaii was incredible. We stayed on the north shore of Oa...

Emily Bergendahl 4/21/16 >

Walking the Golden Gate

Vipul, Our trip to San Francisco was so much fun. We biked over the Golden Gate Bridge on...

Natalia Maric 4/18/16 >

Edit

NEW

What's New

New in iOS 10

NEW

Search in App

CoreSpotlight Search API

Differential Privacy

Visual Preview in Web Markup Tool

What's New

New in iOS 10

NEW

Search in App

CoreSpotlight Search API

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Visual Preview in Web Markup Tool

Adopting Search APIs

Making the most of your content

John Hörnkvist Apple, Inc.

Adopting Search APIs

Steps and best practices

Indexing content

Rich presentation

Launching into your app

CoreSpotlight Search API

Optimize for ranking



CoreSpotlight

Any App Content



CoreSpotlight

Any App Content



NSUserActivity

Viewed App Content



CoreSpotlight

Any App Content



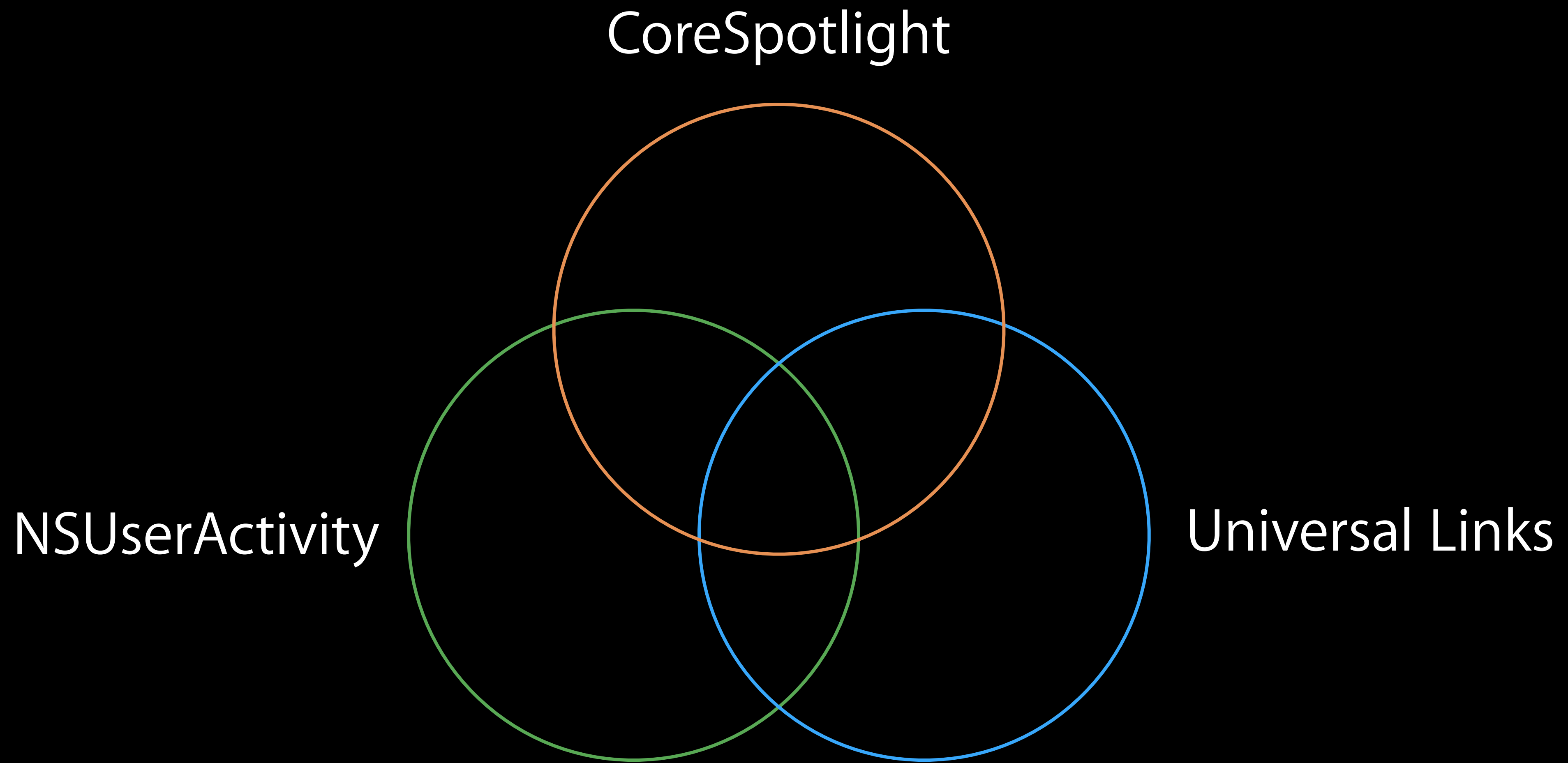
NSUserActivity

Viewed App Content



Universal Links

App Content on Web



Q quinoa



Cancel

GREEN KITCHEN

Show More



Black Quinoa & Kale Salad

Salads, Gluten free, Whole grain, Serves 4, Cooking time 25 min 5 ingredients



Grilled Asparagus & Creamy Lemon Quinoa

Main courses, Gluten free, Serves 4, Cooking time 45 min, 5 ingredients



Black Quinoa & Kale Salad

Salads, Gluten free, Whole grain, Serves 4, Cooking time 25 min 5 ingredients

WIKIPEDIA



Quinoa

Quinoa is a species of the goosefoot genus (*Chenopodium quinoa*), a grain crop grown primarily for its edible se...



SUGGESTED WEBSITE



What is Quinoa?

What is quinoa? Need some healthy vegetarian or vegan quinoa recipes or just some different...

vegetarian.about.com/od/glossary/g/whatisquin...



Quinoa - The World's Healthiest Foods

What's New and Beneficial About Quinoa? The

Adopting Search APIs

Steps and best practices

Indexing content

Rich presentation

Launching into your app

CoreSpotlight Search API

Optimize for ranking

CoreSpotlight

Any App Content

NSUserActivity

Viewed App Content

Universal Links

App Content on Web

Indexing with CoreSpotlight

Index all that your app has to offer

API for on-device indexing on iOS

You decide what you want to add to the index

Documents, game levels, images, jump-off points, and more

CoreSpotlight Refresher

Basic operations

Adding items to the index

```
let attrs : CSSearchableItemAttributeSet =
    CSSearchableItemAttributeSet(itemContentType: kUTTypeItem as String)
attrs.displayName = "Hello world!"
let item = CSSearchableItem(uniqueIdentifier:"hello", domainIdentifier:
    "Greetings", attributeSet: attrs)
CSSearchableIndex.defaultIndex().indexSearchableItems([item],
    completionHandler: handler)
```

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CSSearchableIndex.defaultIndex().indexSearchableItems([item],
    completionHandler: handler)
```

CoreSpotlight Refresher

Basic operations

Deleting items from the index

```
CSSearchableIndex.defaultIndex().deleteSearchableItems(withIdentifiers: ["hello"],  
completionHandler: handler)
```

```
CSSearchableIndex.defaultIndex().deleteSearchableItems(withDomainIdentifiers:  
["Greetings"], completionHandler: handler)
```

```
CSSearchableIndex.defaultIndex().deleteAllSearchableItems(completionHandler: handler)
```


CoreSpotlight Refresher

Basic operations

Deleting items from the index

```
CSSearchableIndex.defaultIndex().deleteSearchableItems(withIdentifiers: ["hello"],  
completionHandler: handler)
```

```
CSSearchableIndex.defaultIndex().deleteSearchableItems(withDomainIdentifiers:  
["Greetings"], completionHandler: handler)
```

```
CSSearchableIndex.defaultIndex().deleteAllSearchableItems(completionHandler: handler)
```

CoreSpotlight Refresher

Basic operations

Deleting items from the index

```
CSSearchableIndex.defaultIndex().deleteSearchableItems(withIdentifiers: ["hello"],  
completionHandler: handler)
```

```
CSSearchableIndex.defaultIndex().deleteSearchableItems(withDomainIdentifiers:  
["Greetings"], completionHandler: handler)
```

```
CSSearchableIndex.defaultIndex().deleteAllSearchableItems(completionHandler: handler)
```

CoreSpotlight Refresher

Basic operations

Deleting items from the index

```
CSSearchableIndex.defaultIndex().deleteSearchableItems(withIdentifiers: ["hello"],  
completionHandler: handler)
```

```
CSSearchableIndex.defaultIndex().deleteSearchableItems(withDomainIdentifiers:  
["Greetings"], completionHandler: handler)
```

```
CSSearchableIndex.defaultIndex().deleteAllSearchableItems(completionHandler: handler)
```

Indexing with CoreSpotlight

Best practices

Registering as an index delegate

Use client state API for asynchronous indexing

Performance considerations

Creating a CoreSpotlight extension

Indexing with CoreSpotlight

Register as an index delegate

Spotlight will reach out to initiate indexing

```
CSSearchableIndex.defaultSearchableIndex().indexDelegate = self
```

Indexing with CoreSpotlight

Implement CSSearchableIndexDelegate protocol

```
func searchableIndex(_: CSSearchableIndex,  
    reindexAllSearchableItemsWithAcknowledgementHandler acknowledgementHandler: () -> Void) {  
    // Reindex everything, then call handler  
    acknowledgementHandler();  
}
```

```
func searchableIndex(_: CSSearchableIndex,  
    reindexSearchableItemsWithIdentifiers identifiers: [String],  
    acknowledgementHandler: () -> Void) {  
    // Reindex items for the identifiers, then call handler  
    acknowledgementHandler()  
}
```

Indexing with CoreSpotlight

Implement CSSearchableIndexDelegate protocol

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func searchableIndex(_: CSSearchableIndex,  
    reindexAllSearchableItemsWithAcknowledgementHandler acknowledgementHandler: () -> Void) {  
    // Reindex everything, then call handler  
    acknowledgementHandler();  
}
```

```
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    acknowledgementHandler: () -> Void) {  
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    acknowledgementHandler()  
}
```

Indexing with CoreSpotlight

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func searchableIndex(_: CSSearchableIndex,  
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    // Reindex everything, then call handler  
    acknowledgementHandler();  
}
```

```
func searchableIndex(_: CSSearchableIndex,  
    reindexSearchableItemsWithIdentifiers identifiers: [String],  
    acknowledgementHandler: () -> Void) {  
    // Reindex items for the identifiers, then call handler  
    acknowledgementHandler()  
}
```


Indexing with CoreSpotlight

Implement CSSearchableIndexDelegate protocol

```
func searchableIndex(_: CSSearchableIndex,  
    reindexAllSearchableItemsWithAcknowledgementHandler acknowledgementHandler: () -> Void) {  
    // Reindex everything, then call handler  
    acknowledgementHandler();  
}
```

```
func searchableIndex(_: CSSearchableIndex,  
    reindexSearchableItemsWithIdentifiers identifiers: [String],  
    acknowledgementHandler: () -> Void) {  
    // Reindex items for the identifiers, then call handler  
    acknowledgementHandler()  
}
```

Indexing with CoreSpotlight

Using client state for asynchronous updates

Allows you to keep your datastore and Spotlight in sync, without blocking

An opaque token stored in Spotlight's index

Used with journals or database annotations

Indexing with CoreSpotlight

Setting client state

Index state uses a named index instance

Create multiple instances if you have more than one data source

Indexing with CoreSpotlight

Setting client state

Index state uses a named index instance

Create multiple instances if you have more than one data source

```
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)
```

Indexing with CoreSpotlight

Setting client state

Index state uses a named index instance

Create multiple instances if you have more than one data source

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

index.beginBatch()

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Indexing with CoreSpotlight

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Indexing with CoreSpotlight

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Indexing with CoreSpotlight

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Indexing with CoreSpotlight

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index.indexSearchableItems(items, completionHandler: nil);

let stateString = String(offset + items.count)

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

Indexing with CoreSpotlight

Checking client state

Fetch client state on launch

Resume interrupted indexing

```
// ** Call on launch to fetch index state and start indexing if needed.
func indexIfNeeded(){
    // ** Create a named index instance.
    let index = CSSearchableIndex(name: "myname")

    // ** Asynchronously fetch our last client state.
    index.fetchLastClientState(completionHandler: { (data, error) in
        if (error != nil) {
            // deal with the error.
        } else if (data != expectedData) {
            // Index state wasn't what we expected. Bring CoreSpotlight up to date.
            self.doIndex(index, data)
        }
    })
}
```

```
// ** Call on launch to fetch index state and start indexing if needed.
func indexIfNeeded(){
    // ** Create a named index instance.
    let index = CSSearchableIndex(name: "myname")

    // ** Asynchronously fetch our last client state.
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            self.doIndex(index, data)
        }
    })
}
```

Indexing with CoreSpotlight

Performance considerations

Minimize overhead, optimize storage and database access

Use batching, size batches for memory overhead

Don't block the main thread

Index on a background thread

CoreSpotlight Extension

Catching up in the background

The extension can index when your app isn't running

Recover after restore from backup

CoreSpotlight Extension

Catching up in the background

The extension can index when your app isn't running

Recover after restore from backup

```
func searchableIndex(_: CSSearchableIndex,  
    reindexAllSearchableItemsWithAcknowledgementHandler acknowledgementHandler: () -> Void) {  
    // Reindex everything, then call handler  
    acknowledgementHandler();  
}
```

```
func searchableIndex(_: CSSearchableIndex,  
    reindexSearchableItemsWithIdentifiers identifiers: [String],  
    acknowledgementHandler: () -> Void) {  
    // Reindex items for the identifiers, then call handler  
    acknowledgementHandler()  
}
```

CoreSpotlight Extension

Catching up in the background

The extension can index when your app isn't running

Recover after restore from backup

Keeping Content Up to Date

Set expiration dates on items that have a natural life span

- CoreSpotlight will call your app to validate expiring item

Use Background Fetch to poll for new content

Use Silent Remote Notifications for push

Keeping Content Up to Date

Set expiration dates on items that have a natural life span

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Use Background Fetch to poll for new content

Use Silent Remote Notifications for push

CoreSpotlight

Any App Content

NSUserActivity

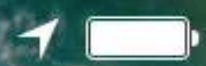
Viewed App Content

Universal Links

App Content on Web



9:41 AM



Messages



Calendar



Photos



Camera



Weather



Clock



Maps



News



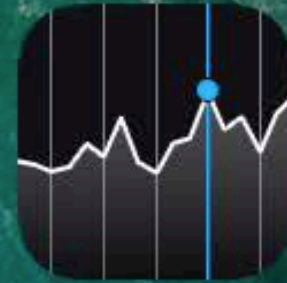
Wallet



Notes



Reminders



Stocks



Videos



iBooks



iTunes Store



App Store



Home



Health



Settings



Green Kitchen



Phone



Mail



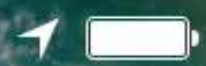
Safari



Music



9:41 AM



Messages



Calendar



Photos



Camera



Weather



Clock



Maps



News



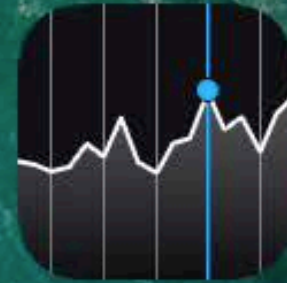
Wallet



Notes



Reminders



Stocks



Videos



iBooks



iTunes Store



App Store



Home



Health



Settings



Green Kitchen



Phone



Mail



Safari



Music

When to Submit NSUserActivities?

Adopting Handoff on iOS and OS X

WWDC 2014

Indexing with NSUserActivity

NSUserActivity

Designate activities as searchable

Add metadata for search and display

Indexing with NSUserActivity

NSUserActivity

Designate activities as searchable

Add metadata for search and display

```
let userActivity = NSUserActivity(activityType: "myActivityType");

userActivity.eligibleForSearch = true

userActivity.title = "title"

let attributes = CSSearchableItemAttributeSet(itemContentType: "public.item")
attributes.displayName = ...

userActivity.contentAttributeSet = attributes
```

Indexing with NSUserActivity

NSUserActivity

Designate activities as searchable

Add metadata for search and display

```
let userActivity = NSUserActivity(activityType: "myActivityType");
```

```
userActivity.eligibleForSearch = true
```

```
userActivity.title = "title"
```

```
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```

```
attributes.displayName = ...
```

```
userActivity.contentAttributeSet = attributes
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Indexing with NSUserActivity

NSUserActivity

Designate activities as searchable

Add metadata for search and display

```
let userActivity = NSUserActivity(activityType: "myActivityType");

userActivity.eligibleForSearch = true

userActivity.title = "title"

let attributes = CSSearchableItemAttributeSet(itemContentType: "public.item")
attributes.displayName = ...

userActivity.contentAttributeSet = attributes
```



9:41 AM

100%

🔍 leek soup



Cancel

GREEN KITCHEN

Show More



Foamy Leek & Sunchoke Soup

Soups, Gluten free, Vegan Serves 4,
Cooking time 1 hour 8 ingredients



Cauliflower Leek Soup

Soups, Gluten free, Vegan Serves 4,
Cooking time 40 min 12 ingredients

WEB VIDEOS

Show More



English Onion & Leek Soup - Jamie at Home

by Jamie Oliver
2/12/2013 • 237K views

YouTube



Potato Leek Soup from Garden Fresh Vegetables

by Brandon & Meredith
6/9/2013 • 29K views

YouTube



Leek and Potato Soup Recipe | Marco Pierre W...

by KnorrRecipes
1/6/2011 • 150K views

YouTube

NSUserActivity and CSSearchableItem

Tying them together

NSUserActivity reflects what the user did

CSSearchableItem reflects what your app has

relatedUniquelIdentifier ties them together

NSUserActivity and CSSearchableItem

Tying them together

NSUserActivity reflects what the user did

CSSearchableItem reflects what your app has

relatedUniquelIdentifier ties them together

```
let userActivity = NSUserActivity(activityType: "myActivityType");
let attributes = CSSearchableItemAttributeSet(itemContentType: "public.item")
attributes.displayName = "Private content!"

attributes.relatedUniquelIdentifier = "myIdentifier"

userActivity.contentAttributeSet = attributes
```

NSUserActivity and CSSearchableItem

Tying them together

NSUserActivity reflects what the user did

CSSearchableItem reflects what your app has

relatedUniquelIdentifier ties them together

```
let userActivity = NSUserActivity(activityType: "myActivityType");  
let attributes = CSSearchableItemAttributeSet(itemContentType: "public.item")  
attributes.displayName = "Private content!"
```

```
attributes.relatedUniquelIdentifier = "myIdentifier"
```

```
userActivity.contentAttributeSet = attributes
```


NSUserActivity and CSSearchableItem

NEW

Tying them weakly

New in iOS 10: `weakRelatedUniquelIdentifier`

- `relatedUniquelIdentifier` binds strongly
- `weakRelatedUniquelIdentifier` binds weakly

A weakly bound `NSUserActivity` can exist without a matching `CSSearchableItem`

Not suitable for user controlled content

NSUserActivity and CSSearchableItem

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Tying them weakly

New in iOS 10: `weakRelatedUniqueIdentifier`

- `relatedUniqueIdentifier` binds strongly
- `weakRelatedUniqueIdentifier` binds weakly

A weakly bound `NSUserActivity` can exist without a matching `CSSearchableItem`

Not suitable for user controlled content

```
let userActivity = NSUserActivity(activityType: "myActivityType");
let attributes = CSSearchableItemAttributeSet(itemContentType: "public.item")
attributes.displayName = "Poutine"

attributes.weakRelatedUniqueIdentifier = "myIdentifier"

userActivity.contentAttributeSet = attributes
```

NSUserActivity and CSSearchableItem

NEW

Tying them weakly

New in iOS 10: `weakRelatedUniqueIdentifier`

- `relatedUniqueIdentifier` binds strongly
- `weakRelatedUniqueIdentifier` binds weakly

A weakly bound `NSUserActivity` can exist without a matching `CSSearchableItem`

Not suitable for user controlled content

```
let userActivity = NSUserActivity(activityType: "myActivityType");
let attributes = CSSearchableItemAttributeSet(itemContentType: "public.item")
attributes.displayName = "Poutine"
```

```
attributes.weakRelatedUniqueIdentifier = "myIdentifier"
```

```
userActivity.contentAttributeSet = attributes
```

NSUserActivity Deletion

domainIdentifier for NSUserActivity

NEW

New in iOS 10: Use domainIdentifier with NSUserActivity

Part of CSSearchableItemAttributeSet

Delete user activities in bulk by domainIdentifier

NSUserActivity Deletion

NEW

domainIdentifier for NSUserActivity

New in iOS 10: Use domainIdentifier with NSUserActivity

Part of CSSearchableItemAttributeSet

Delete user activities in bulk by domainIdentifier

```
let userActivity = NSUserActivity(activityType: "myActivityType");
let attributes = CSSearchableItemAttributeSet(itemContentType: "public.item")
attributes.domainIdentifier = "account1"
userActivity.contentAttributeSet = attributes
```

NSUserActivity Deletion

NEW

domainIdentifier for NSUserActivity

New in iOS 10: Use domainIdentifier with NSUserActivity

Part of CSSearchableItemAttributeSet

Delete user activities in bulk by domainIdentifier

```
let ci = CSSearchableIndex.defaultSearchableIndex();

ci.deleteSearchableItems(withDomainIdentifiers:["account1"]) { error in
    // ..
}
```

CoreSpotlight

Any App Content

NSUserActivity

Viewed App Content

Universal Links

App Content on Web

Indexing Universal Links

Content available on the web and in app

Index public content, including large indexes

Reach new users—results shown even if users do not have your app

Results shown in Spotlight and Safari

Indexing Universal Links

Steps

-
- | | |
|-------------------|--|
| 1. Allow Indexing | Allow Applebot, include domain in iTunes Connect |
| 2. Deep Linking | Support Universal Links and Smart App Banners |
| 3. Markup | Markup website with schema.org and Open Graph |
| 4. Restoring | Update app to properly open deep links |
| 5. Test | Test URLs with App Search API Validation Tool |
-

Indexing Universal Links

Steps

-
- | | |
|-------------------|--|
| 1. Allow Indexing | Allow Applebot, include domain in iTunes Connect |
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| 5. Test | Test URLs with App Search API Validation Tool |
-

Support Universal Links—iOS Developer Library

Indexing Universal Links

Supported Schemas

AggregateRating

InteractionCount

Offers

PriceRange

Organization

Recipe

SearchAction

ImageObject

Visual Preview in API Validation Tool

NEW

<https://search.developer.apple.com>

Visual Preview in API Validation Tool

NEW

<https://search.developer.apple.com>

Visual Preview in API Validation Tool

NEW

The screenshot shows the 'App Search API Validation Tool' interface. At the top, there's a navigation bar with 'Developer', 'Platforms', 'Resources', 'Program', 'Support', and 'Member Center'. Below this is a search icon and the title 'App Search API Validation Tool'. A sub-header explains the tool's purpose: 'Test your webpage for iOS 9 Search APIs. Enter a URL and Applebot will crawl your webpage and show how you can optimize for best results. [Learn more about Search for Developers.](#)'

The main input area contains a text box with the URL 'https://www.tripadvisor.com/Restaurant_Review-g60713-d4715271-Reviews-Shorty_Goldstein_s-San_Francisco_' and a blue 'Test URL' button.

Below the input is a visual preview of a search result for 'Shorty Goldstein's, San Francisco - Financial District'. The preview includes the TripAdvisor logo, the restaurant name, a truncated title, a description, and a 4.5-star rating with 12 reviews.

At the bottom, there is a table with the following columns: Element, Status, Extracted Data, and CSSearchableItemAttributeSet. The table contains three rows of data:

Element	Status	Extracted Data	CSSearchableItemAttributeSet
Title	RECOMMENDED Title may be truncated. Try to avoid unnecessarily long or verbose titles.	Shorty Goldstein's, San Francisco - Financial District - Menu, Prices & Restaurant Reviews - TripAdvisor	displayName
Description	RECOMMENDED Description may be truncated. Try to avoid unnecessarily long or verbose descriptions.	Shorty Goldstein's, San Francisco: See 12 unbiased reviews of Shorty Goldstein's, rated 4.5 of 5 on TripAdvisor and ranked #1,227 of 5,439 restaurants in San Francisco.	contentDescription
Image	PASSED	https://static.tacdn.com/img2/branding/TA_550x370.png	thumbnailData

Visual Preview in API Validation Tool

NEW

The screenshot shows the 'App Search API Validation Tool' interface. At the top, there's a navigation bar with 'Developer', 'Platforms', 'Resources', 'Program', 'Support', and 'Member Center'. The main heading is 'App Search API Validation Tool' with a magnifying glass icon. Below the heading, a text block explains the tool's purpose: 'Test your webpage for iOS 9 Search APIs. Enter a URL and Applebot will crawl your webpage and show how you can optimize for best results. [Learn more about Search for Developers.](#)'

A text input field contains the URL: `https://www.tripadvisor.com/Restaurant_Review-g60713-d4715271-Reviews-Shorty_Goldstein_s-San_Francisco_`. To its right is a blue 'Test URL' button.

Below the input is a visual preview of a search result for 'Shorty Goldstein's, San Francisco - Financial District - ...'. The preview includes the TripAdvisor logo, the title, a description, and a 4.5-star rating with 12 reviews. Three yellow arrows point from the preview to labels on the right: 'Title', 'Description', and 'Markup'.

At the bottom, a table displays the extracted data for each element:

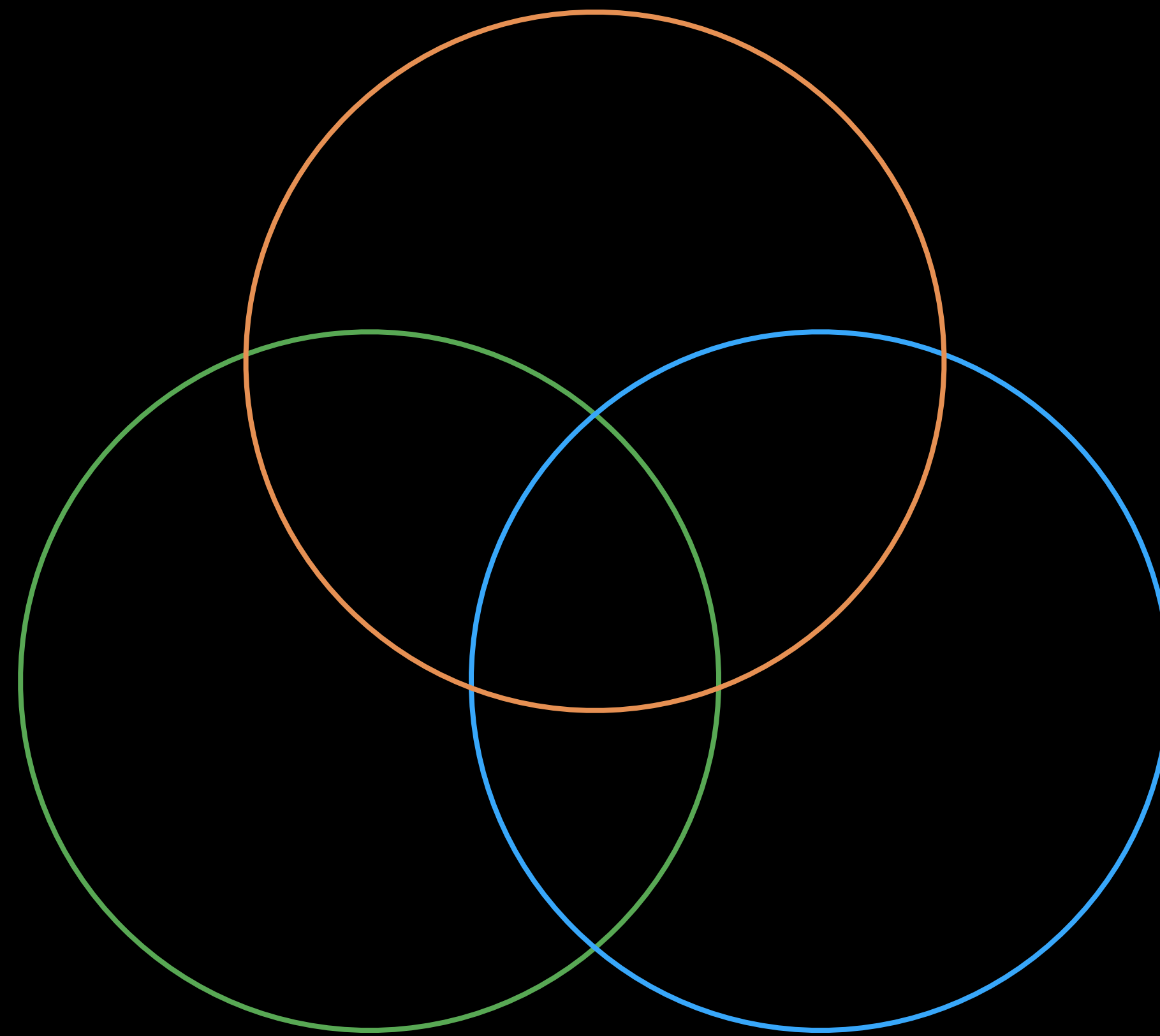
Element	Status	Extracted Data	CSSearchableItemAttributeSet
Title	RECOMMENDED Title may be truncated. Try to avoid unnecessarily long or verbose titles.	Shorty Goldstein's, San Francisco - Financial District - Menu, Prices & Restaurant Reviews - TripAdvisor	displayName
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Image	PASSED	https://static.tacdn.com/img2/branding/TA_550x370.png	thumbnailData

Tying Them All Together

CoreSpotlight

NSUserActivity

Universal Links

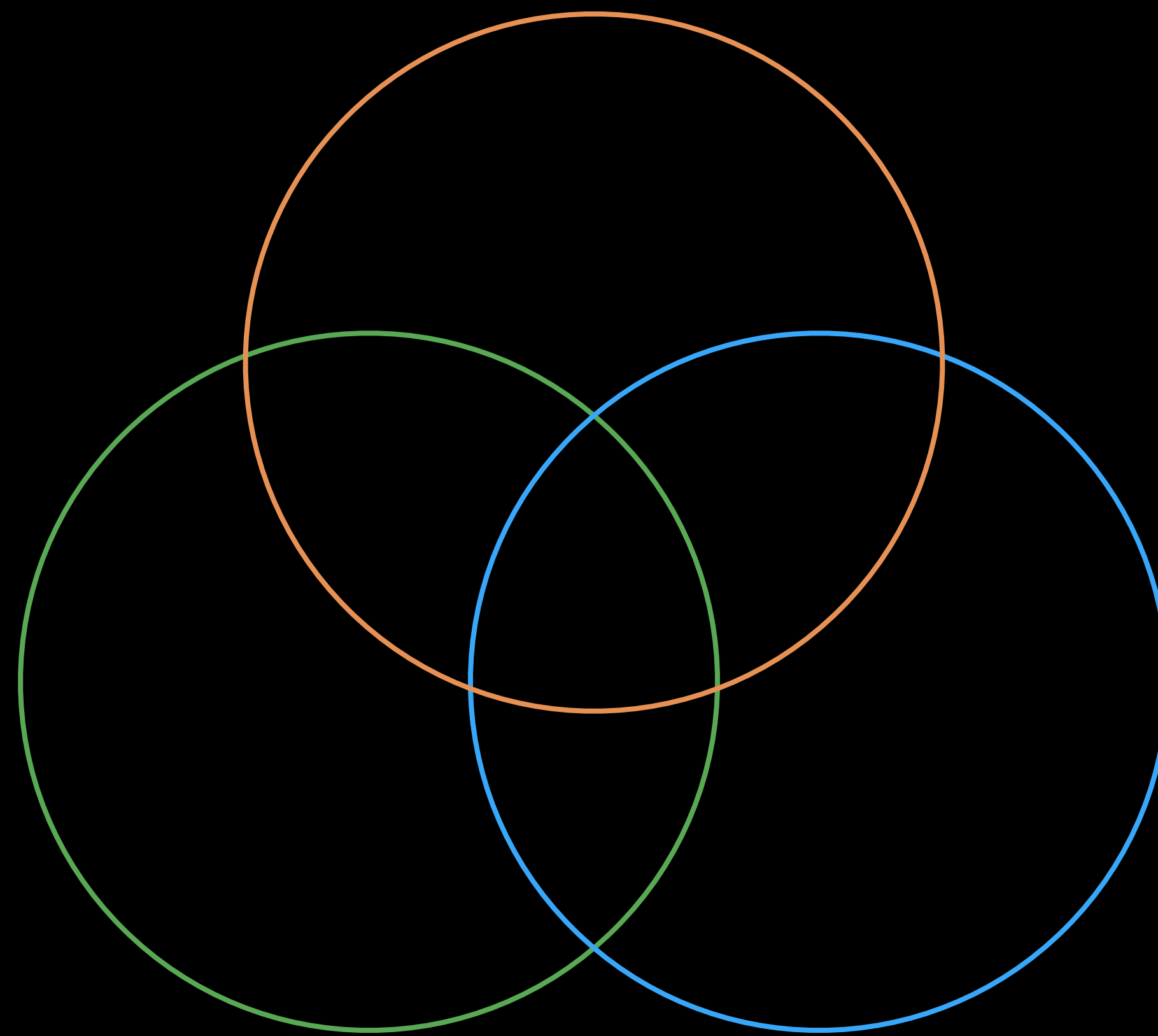


Tying Them All Together

CoreSpotlight

```
NSUserActivity  
.contentAttributeSet  
.relatedUniqueIdentifier =  
  CSSearchableItem.  
  uniqueIdentifier
```

NSUserActivity



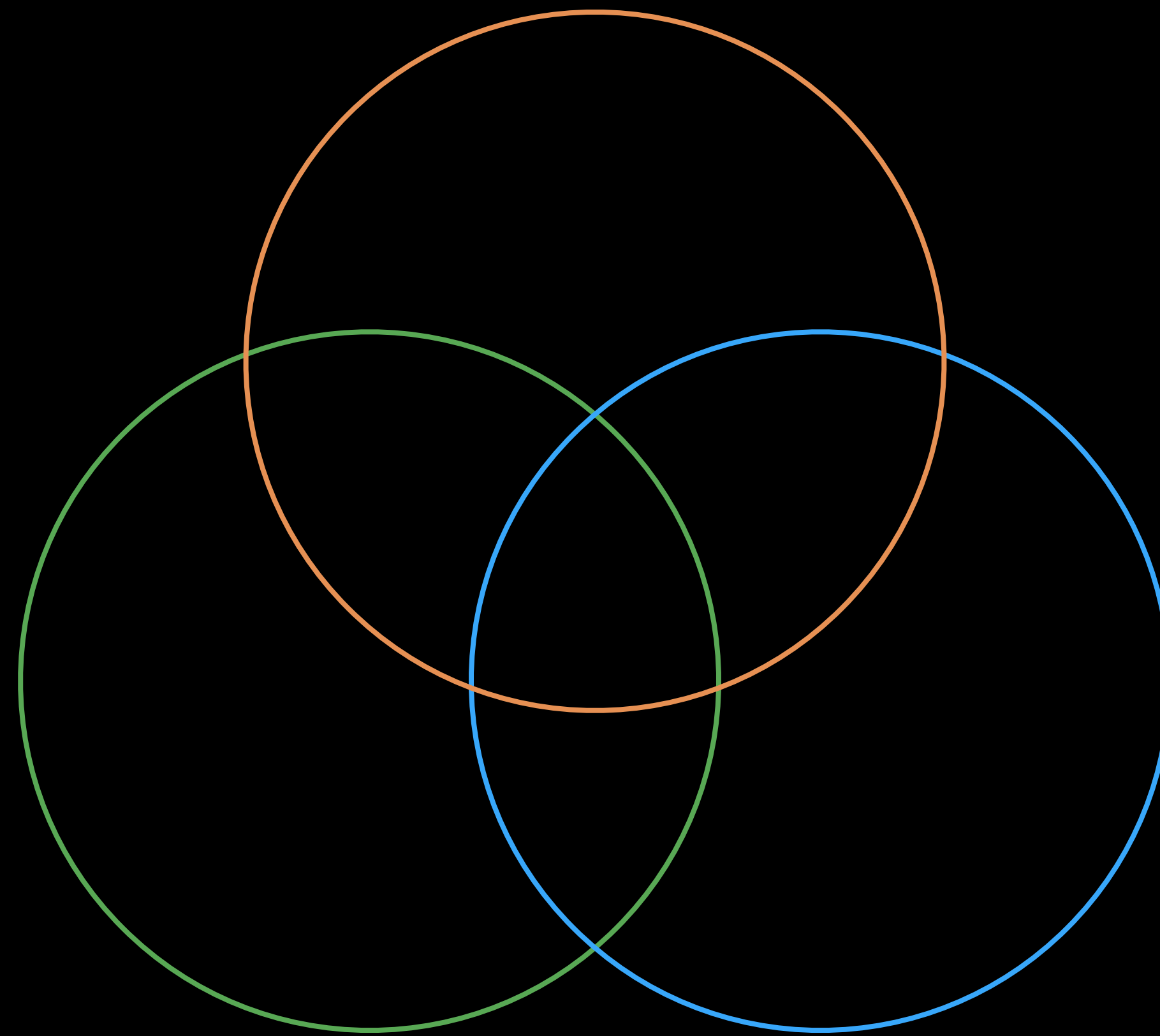
Universal Links

Tying Them All Together

CoreSpotlight

```
NSUserActivity  
.contentAttributeSet  
.relatedUniqueIdentifier =  
CSSearchableItem.  
uniqueIdentifier
```

NSUserActivity



```
CSSearchableItem.contentURL =  
Web page URL
```

Universal Links

Tying Them All Together

CoreSpotlight

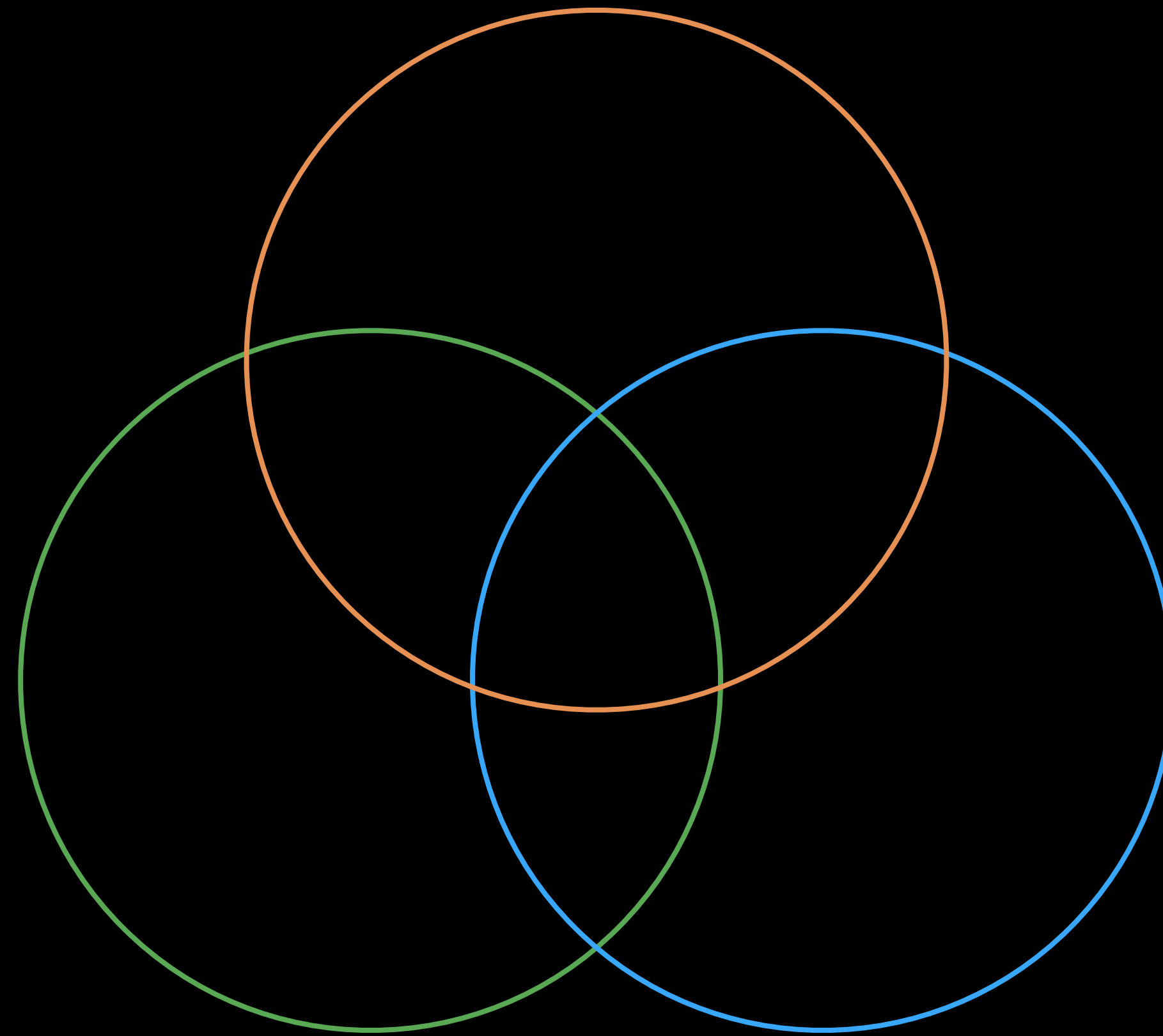
```
NSUserActivity  
.contentAttributeSet  
.relatedUniqueIdentifier =  
CSSearchableItem.  
uniqueIdentifier
```

NSUserActivity

```
CSSearchableItem.contentURL =  
Web page URL
```

Universal Links

```
NSUserActivity.webpageURL = Web Page URL
```



Adopting Search APIs

Steps and best practices

Indexing content

Rich presentation

Launching into your app

CoreSpotlight Search API

Optimize for ranking

Creating a Great Visual Experience

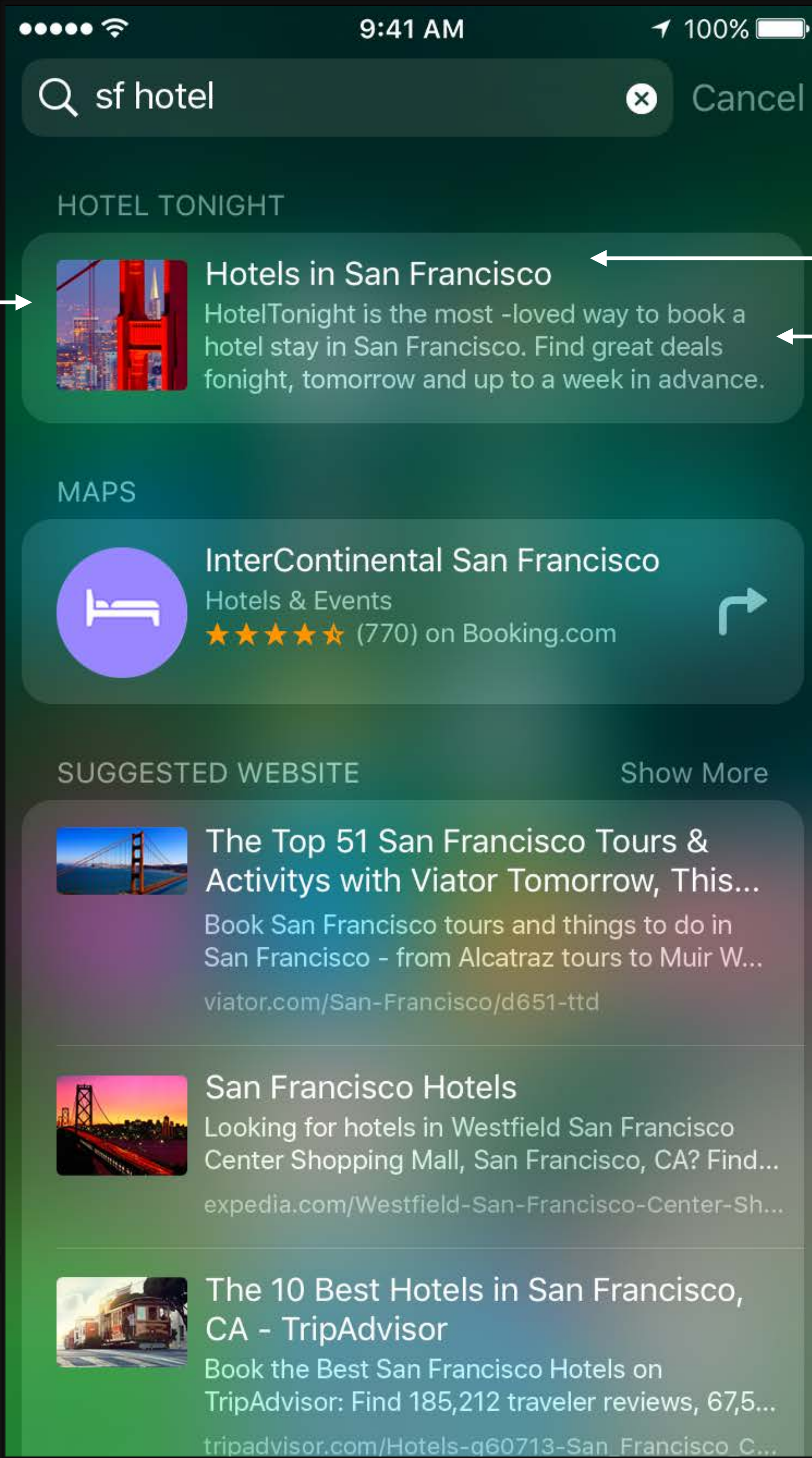


Provide descriptive title, description, and compelling thumbnail

Set the right contentType for your content

Use attributes to fill out the UI

Element	CoreSpotlight	Web Markup
Thumbnail	thumbnailURL	og:image
Title	title	og:title
Description	contentDescription	og:description
Metadata	rating, ratingDescription, completionDate, dueDate, startDate, endDate, allDay, fileSize, pageCount	aggregateRating, InteractionCount, Offers, PriceRange, Organization, Recipe, SearchAction, ImageObject



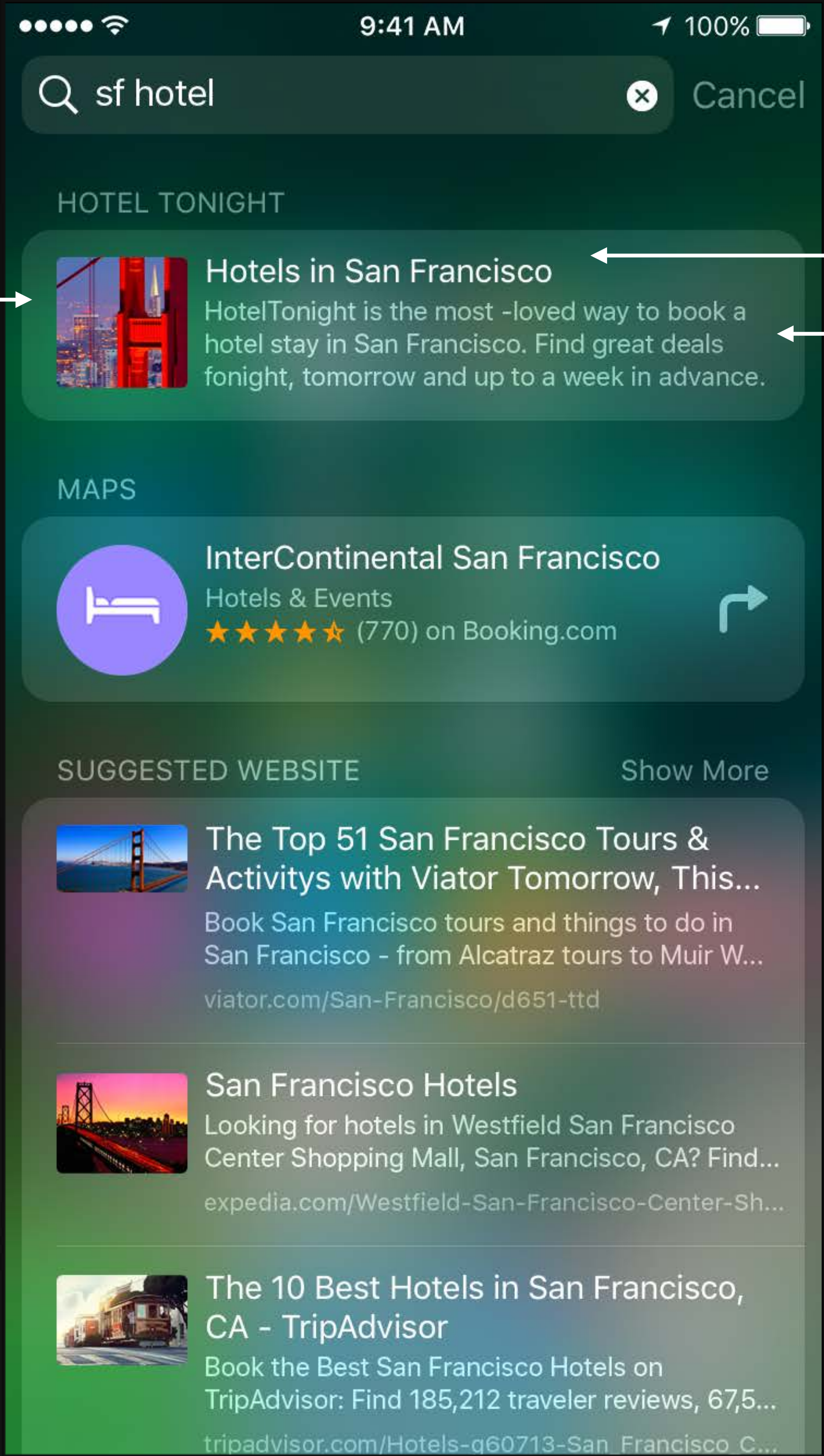
attributes.thumbnailURL



attributes.title

attributes.contentDescription





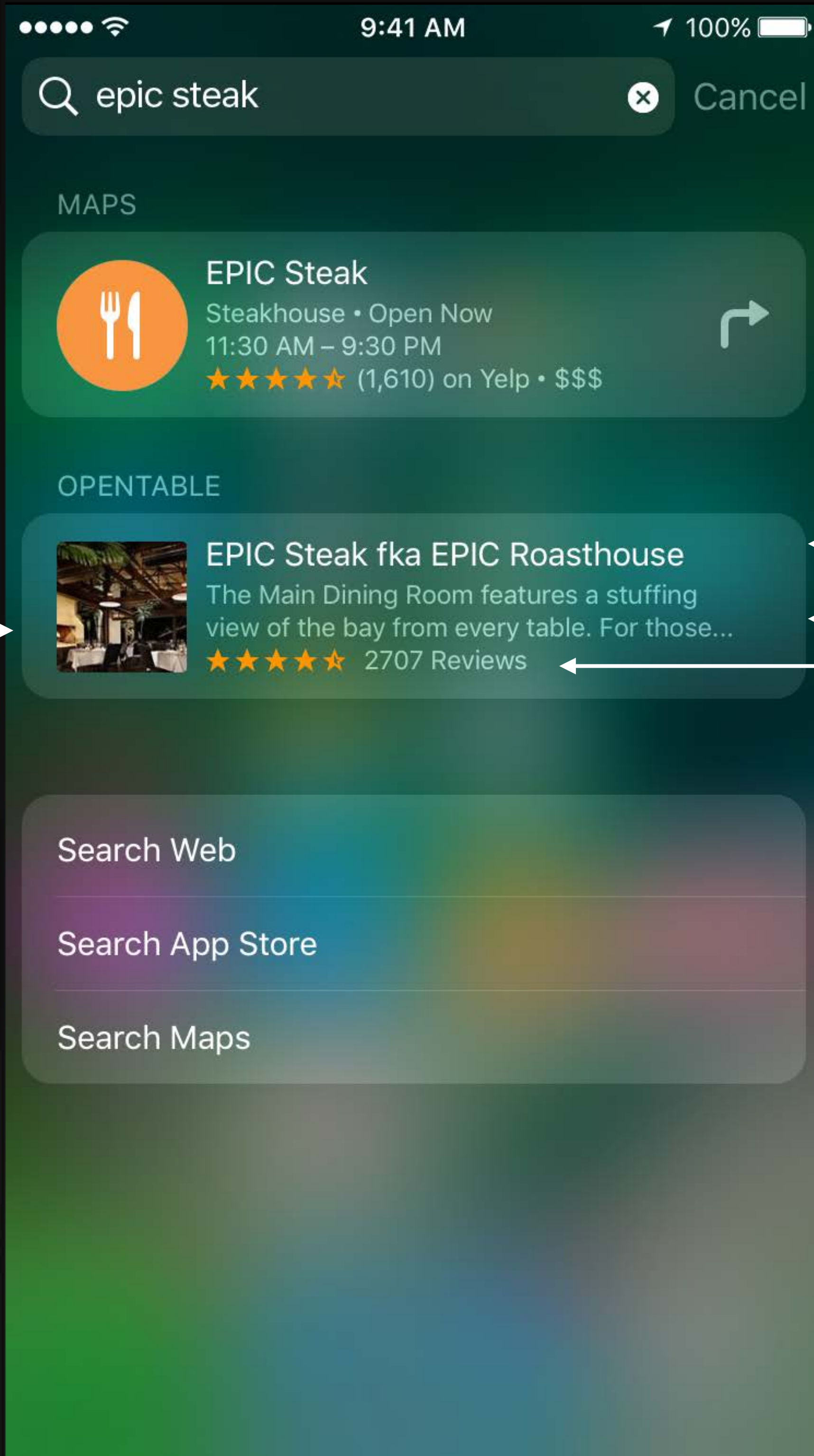
og: image



og: title

og: description





attributes.thumbnailURL



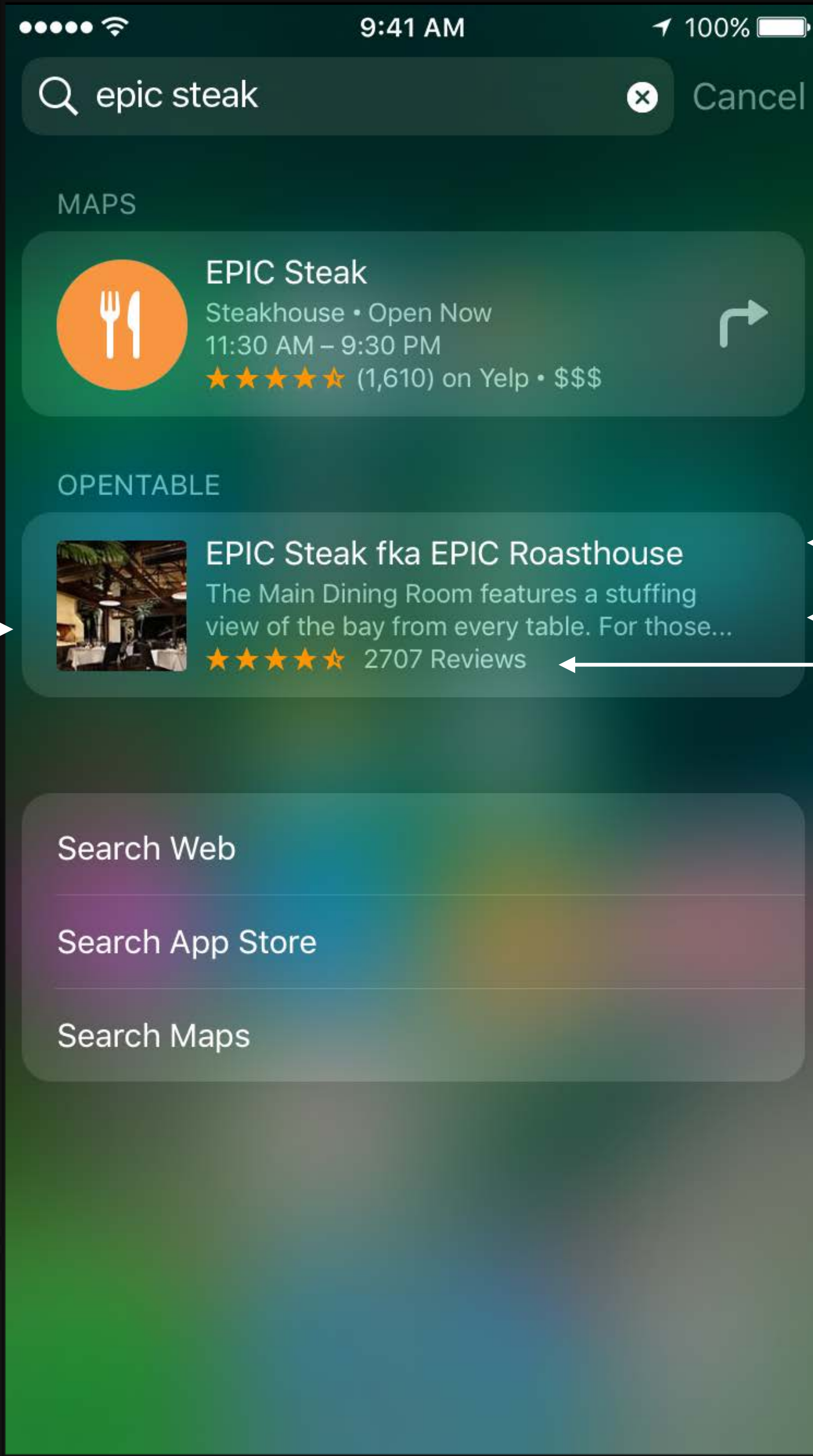
attributes.title

attributes.contentDescription

attributes.rating

attributes.ratingDescription





og: image



og: title

og: description

aggregateRating.ratingValue
aggregateRating.reviewCount



Creating a Great 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

Enable quick actions, like directions and calling

Launch straight to content, without interstitials or multi-step builds



9:41 AM



Q san francisco



Cancel

REDFIN



1770 Pacific Ave #302 | MLS ID 445463

San Francisco, CA 94109 For sale for \$1,595,000 2 Bd, 2 Ba, 1,500 Sq. Ft.



1788 Clay #211 | MLS ID 445463

San Francisco, CA 94109 For sale for \$1,549,000 2 Bd, 2 Ba, 1,294 Sq. Ft.



1788 Clay #211 | MLS ID 445463

San Francisco, CA 94109 For sale for \$1,549,000 2 Bd, 2 Ba, 1,294 Sq. Ft.



GUIDES



Rich Table

Satisfy cravings for taste adventures at Rich Table, home of dried porcini doughnuts with Raclette Dipping S...



San Francisco Disc Golf

Wander the tranquil fairy-tale woods of outer Golden Gate Park, and you'll find fierce Frisbee golf games in pro...



San Francisco Golden Gate Park

WHen San Franciscans refer to 'the park,' there's only one that gets the




san francisco Cancel

REDFIN


 1770 Pacific Ave #302 | MLS ID 445463
 San Francisco, CA 94109 For sale for \$1,595,000 2 Bd, 2 Ba, 1,500 Sq. Ft.



attributes.latitude
attributes.longitude
attributes.supportsNavigation

 1788 Clay #211 | MLS ID 445463
 San Francisco, CA 94109 For sale for \$1,549,000 2 Bd, 2 Ba, 1,294 Sq. Ft.



 1788 Clay #211 | MLS ID 445463
 San Francisco, CA 94109 For sale for \$1,549,000 2 Bd, 2 Ba, 1,294 Sq. Ft.



GUIDES

 Rich Table
 Satisfy cravings for taste adventures at Rich Table, home of dried porcini doughnuts with Raclette Dipping S...



attributes.supportsPhoneCall
attributes.phoneNumbers

 San Francisco Disc Golf
 Wander the tranquil fairy-tale woods of outer Golden Gate Park, and you'll find fierce Frisbee golf games in pro...



 San Francisco Golden Gate Park
 When San Franciscans refer to 'the park,' there's only one that gets the



san francisco Cancel

REDFIN


 **1770 Pacific Ave #302 | MLS ID 445463**
 San Francisco, CA 94109 For sale for \$1,595,000 2 Bd, 2 Ba, 1,500 Sq. Ft.



PostalAddress

 **1788 Clay #211 | MLS ID 445463**
 San Francisco, CA 94109 For sale for \$1,549,000 2 Bd, 2 Ba, 1,294 Sq. Ft.



 **1788 Clay #211 | MLS ID 445463**
 San Francisco, CA 94109 For sale for \$1,549,000 2 Bd, 2 Ba, 1,294 Sq. Ft.



GUIDES

 **Rich Table**
 Satisfy cravings for taste adventures at Rich Table, home of dried porcini doughnuts with Raclette Dipping S...



telephone

 **San Francisco Disc Golf**
 Wander the tranquil fairy-tale woods of outer Golden Gate Park, and you'll find fierce Frisbee golf games in pro...



 **San Francisco Golden Gate Park**
 When San Franciscans refer to 'the park,' there's only one that gets the



Adopting Search APIs

Steps and best practices

Indexing content

Rich presentation

Launching into your app

CoreSpotlight Search API

Optimize for ranking

Restoring with NSUserActivity

Used for CoreSpotlight and NSUserActivity

Restoring with NSUserActivity

Used for CoreSpotlight and NSUserActivity

```
func application(application: UIApplication, 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
    }
    return false
}
```


Restoring Universal Links

Universal Link support in your app delegate

Restoring Universal Links

Universal Link support in your app delegate

```
func application(application: UIApplication,
                continueUserActivity uA: NSUserActivity,
                restorationHandler: ([AnyObject]?) -> Void) -> Bool {
    if uA.activityType == NSUserActivityTypeBrowsingWeb {
        if let url = uA.webPageURL {
            if let components = NSURLComponents(url: uA.webPageURL,
                                                resolvingAgainstBaseURL: true) {
                let path = components.path, let query = components.query {
                    // Show the found item!
                }
            }
        }
        return true
    }
    return false
}
```

Continue Search in App

NEW

Search in App brings users back to your app

Simple adoption

Leverage your customized search interface

Widely adopted in system apps



9:41 AM



Q trip



Cancel

MAIL

Search in App



Katie Ables

2/21/16, 9:07 AM

Trip to San Francisco

Vipul, Visiting you in San Francisco was so much fun. We definitely need to head back...



Ethan Izzarelli

2/15/16, 12:22 AM

Surfing Trip

Hey Vipul, Our surfing trip to Hawaii was incredible. We stayed on the north shore...



Derek Parker

2/3/16, 7:07 PM

Australia Trip

Hi Vipul, Our family vacation to Australia was incredible. We visited Sydney, Brisbane...

PINTEREST



Trips around the world

Sanaa Lathan I love travel. These are dream images. 569 Pins

WIKIHOW



How to Plan a Backpacking Trip

With a little effort, backpacking trips can be serious fun. A well-planned trip will all...

Search Web

NEW

trip Cancel

NEW

MAIL Search in App

- Katie Ables** 2/21/16, 9:07 AM
Trip to San Francisco
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WIKIHOW

How to Plan a Backpacking Trip
With a little effort, backpacking trips can be serious fun. A well-planned trip will all...

Search Web

Users can continue their Search in the App



9:41 AM

100%

🔍 Trip



Cancel

All Mailboxes

Current Mailbox

John Baily 5/21/16 >

Yosemite Trip

Hey Vipul, We're getting excited for our trip to Yosemite this summer. The kids are going to h...

Katie Abeles 5/20/16 >

Trip to San Francisco

Vipul, Visiting you in San Francisco was so much fun. We definitely need to head back soon. Her...

Derek Parker 5/3/16 >

Australia Trip

Hi Vipul, Our family vacation to Australia was incredible. We visited Sydney, Brisbane, and M...

Ethan Izzarelli 4/22/16 >

Surfing Trip

Hey Vipul, Our surfing trip to Hawaii was incredible. We stayed on the north shore of Oa...

Emily Bergendahl 4/21/16 >

Walking the Golden Gate

Vipul, Our trip to San Francisco was so much fun. We biked over the Golden Gate Bridge on...

Natalia Maric 4/18/16 >

Edit

NEW

Enabling Search Continuation

NEW

Declare that your app supports Search Continuation

Add a `CoreSpotlightContinuation` key in your Info.plist

Implement user activity support

Enabling Search Continuation

NEW

Declare that your app supports Search Continuation

Add a `CoreSpotlightContinuation` key in your Info.plist

Implement user activity support

```
func application(application: UIApplication, continueUserActivity userActivity:
NSUserActivity, restorationHandler: ([AnyObject]?) -> Void) -> Bool {
    if userActivity.activityType == CSQueryContinuationActionType {
        if let searchQuery = userActivity.userInfo?[CSSearchQueryString] as? String {
            // Invoke your search UI!
        }
        return true
    }
    return false
}
```


Adopting Search APIs

Steps and best practices

Indexing content

Rich presentation

Launching into your app

CoreSpotlight Search API

Optimize for ranking

Introducing CoreSpotlight Search API

NEW

Search your Spotlight index

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

One index—great for power and performance

Combine with your own network search for responsiveness and completeness

Trip Cancel

Search for "Trip"

People

Montana Triplett

David Triptree

Sender contains: Trip

Subjects

Subject contains: Trip

Trip to San Francisco

Maui trip - flight booking - landing page

Biz trip like a boss

Yosemite Trip

Australia Trip

Surfing Trip

More Savings for Your Oakland Trip!

CoreSpotlight Search API

NEW

API for your application to query it's own data in the Spotlight index

Fast and scalable

Simple, easy to use API

Powerful query syntax

```
playCount > 1 && (composer == "beethoven"cwd || composer="mozart"cwd) &&  
InRange(tempo, 40, 80)
```

```
* = "bob*"cwd && textContent="project updates"cwdt
```

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```

Query Syntax

NEW

* == "johnny appleseed"

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

NEW

```
* == "johnny appleseed" c w d t
```

Feature

Flag

Case insensitive

'c'

Diacritics insensitive

'd'

Word matching

'w'

Tokenized

't'

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

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

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

    query.start()
}
```


NEW

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NEW

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func search(userQuery : String) {
    query.cancel();
    let escapedString = userQuery.replacingOccurrences(of: "\\\"", with: "\\\\")
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    let queryString = "**=\\" + escapedString + "\"cwdt"
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NEW

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```

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

    query.foundItemsHandler = {
        (items : [CSSearchableItem]) -> Void in
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    }

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}
```

Demo

New Core Spotlight Search API

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Optimizing for ranking

Optimizing for Ranking

Vipul Ved Prakash Apple, Inc.

Ranking

Insight into Spotlight's ranking algorithm

Ranking

Insight into Spotlight's ranking algorithm

Engagement Ratio

Content Popularity

Other Factors

Engagement Ratio

Historical app performance

Device Side

Per Query

Global

Content Popularity

View and Link Counts

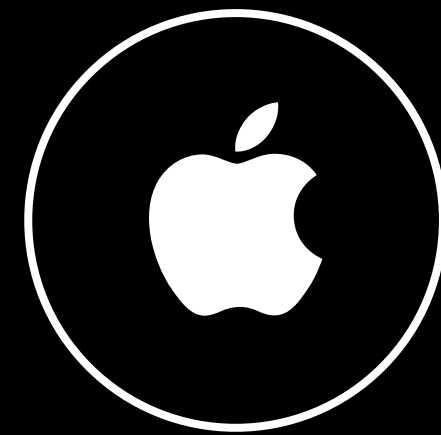
URL Reputation

NSUserActivity

Universal Link
Popularity

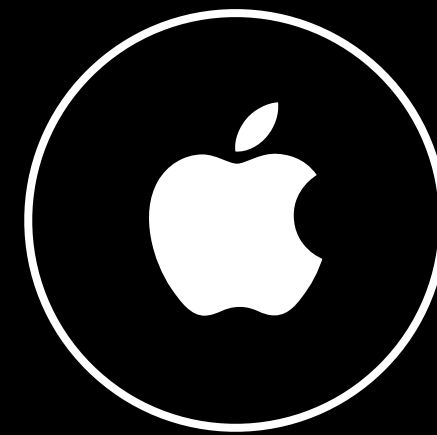
Universal Link Popularity

NEW



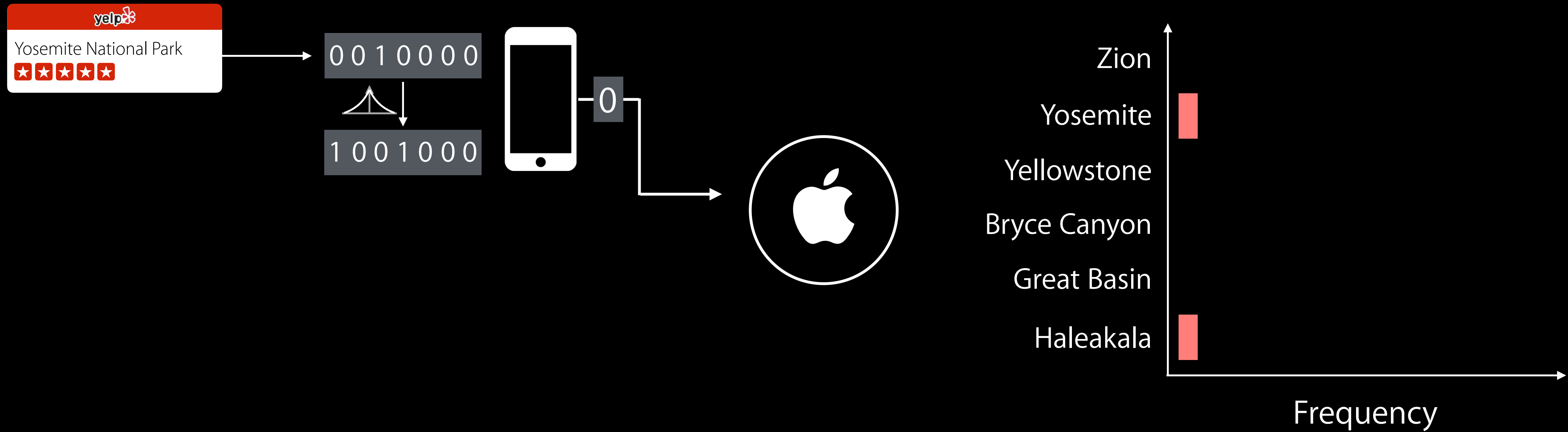
Universal Link Popularity

NEW



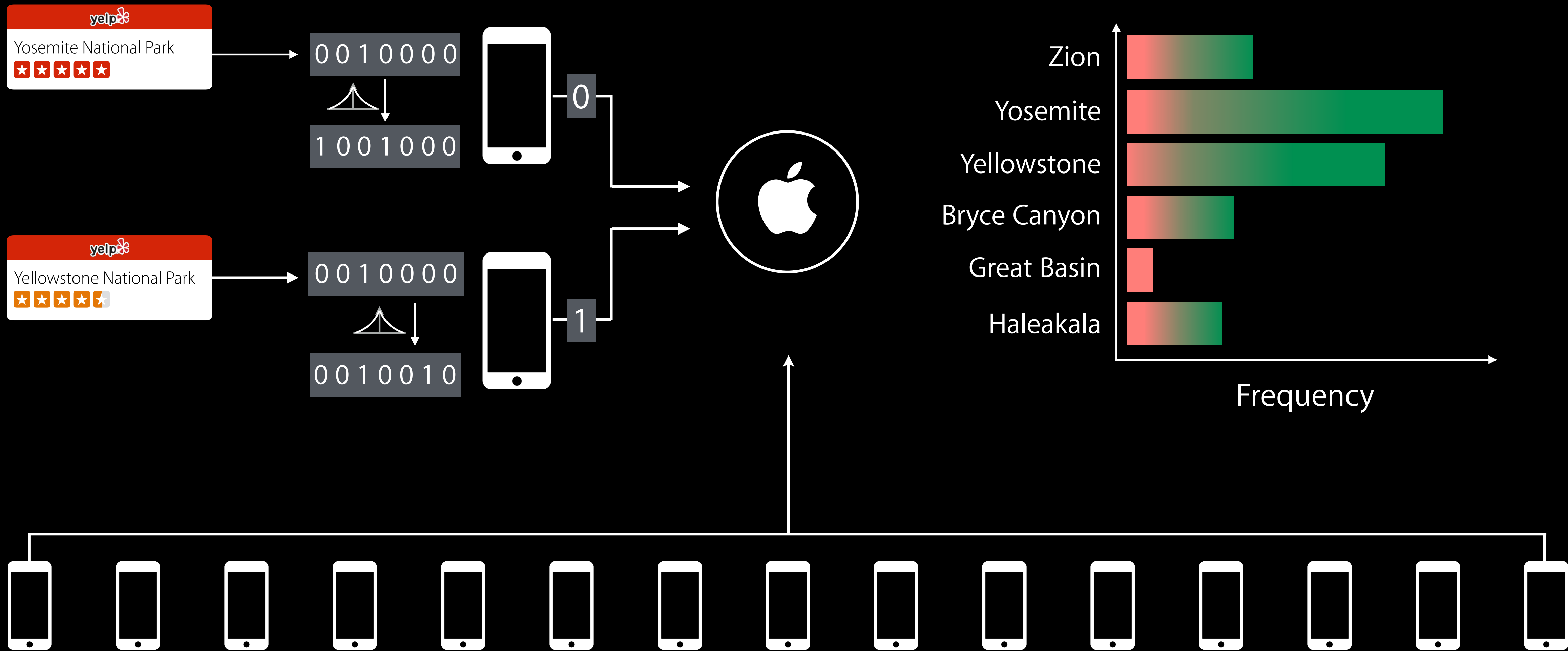
Universal Link Popularity

NEW



Universal Link Popularity

NEW



Best Practices for Ranking

Elements of Success



Follow CoreSpotlight best practices

Index Universal Links

Link NSUserActivities to Universal Links and CoreSpotlight items

Provide relevant content and rich presentation

Implement continue Search in App

Conclusion

Key Take-Aways

Spotlight is universal search on iOS

Customers expect well functioning apps to be searchable

If you have not implemented Search APIs, update today

New features for deeper search and increased engagement

Related Sessions

Engineering Privacy for Your Users	Pacific Heights	Wednesday 4:00PM
Introducing SiriKit	Presidio	Wednesday 5:00PM
Increase Usage of Your App With Proactive Suggestions	Mission	Friday 1:40PM

Labs

App Search and Spotlight Lab

Frameworks Lab A

Thursday 12:00PM

More Information

<https://developer.apple.com/wwdc16/223>

<https://search.developer.apple.com>



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