Using Core Location in iOS 4

Morgan Grainger
Software Engineer

Why Are You Here?

You want to…

- Make your applications easier to use, more intuitive
- Want to get started on a new location-aware app

Agenda

- Why use location?
- How does it work?
- How do you use it?
- What's new?

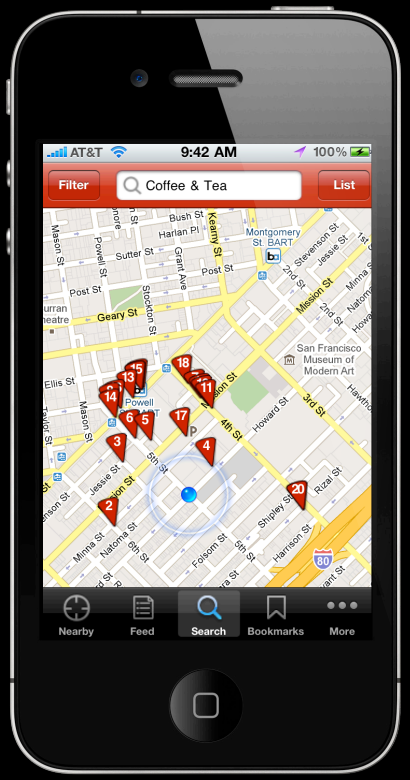
Why Use Location?

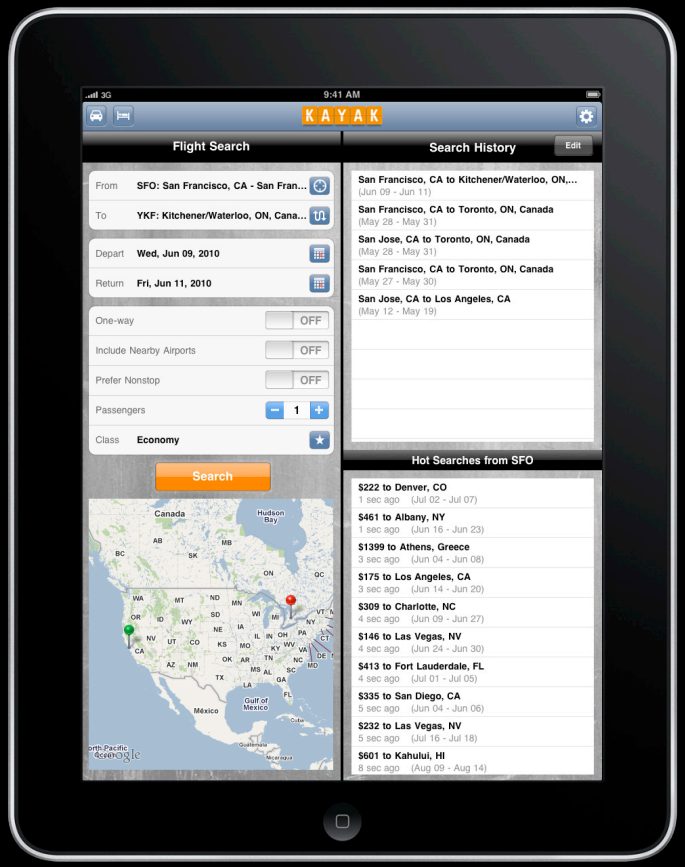
Current Location

Navigation

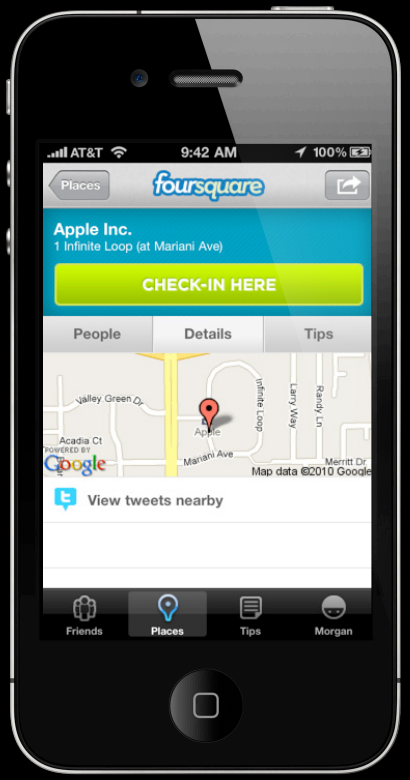

Lamberton Rd
29
195
Morton Avenue
Soloff
Baylor
Independence Ave
Broad
295
Clinton
Maddock
Thropp Ave
Churchill
Hunter Ave
Beech Ave
Edward
Exton Ave
Irvington Pl
Ritz Ave
McGalliard
MENU
Yardville, NJ
EXIT
60
ETA
10:19 a
DISTANCE
1.8 mi
Exit 60 - I-195 East
0.2
mi

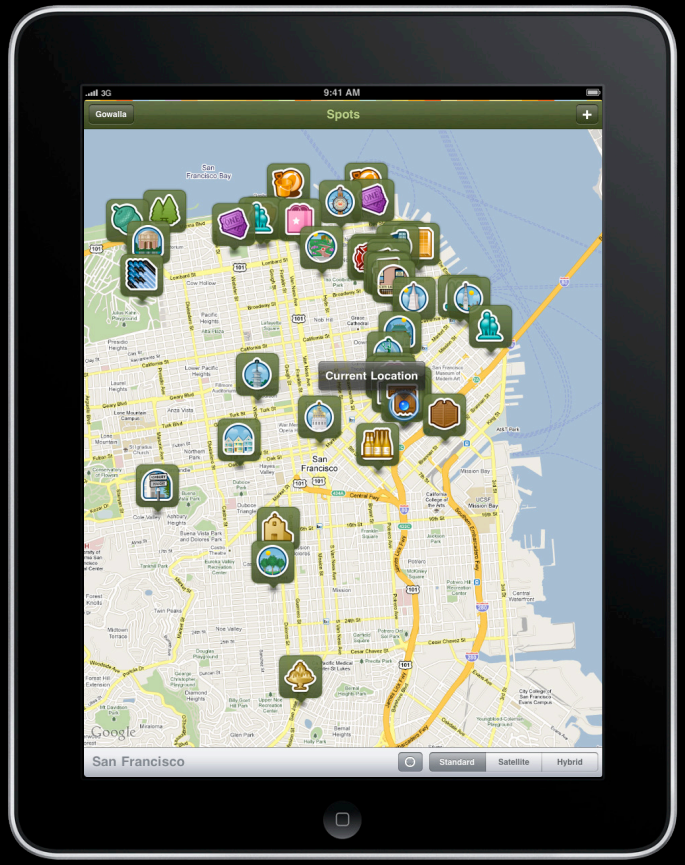
Contextual Location





Social Location





Why Use Location?

Location provides context

- More intuitive applications
- Enhances the experience for your users
- Enables new use cases

Location In-Depth

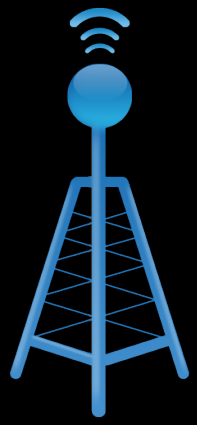
How does it work?

Location In-Depth

Agenda

- How does it work?
  - Three positioning technologies
- What does it mean for your applications?

Three Positioning Methods

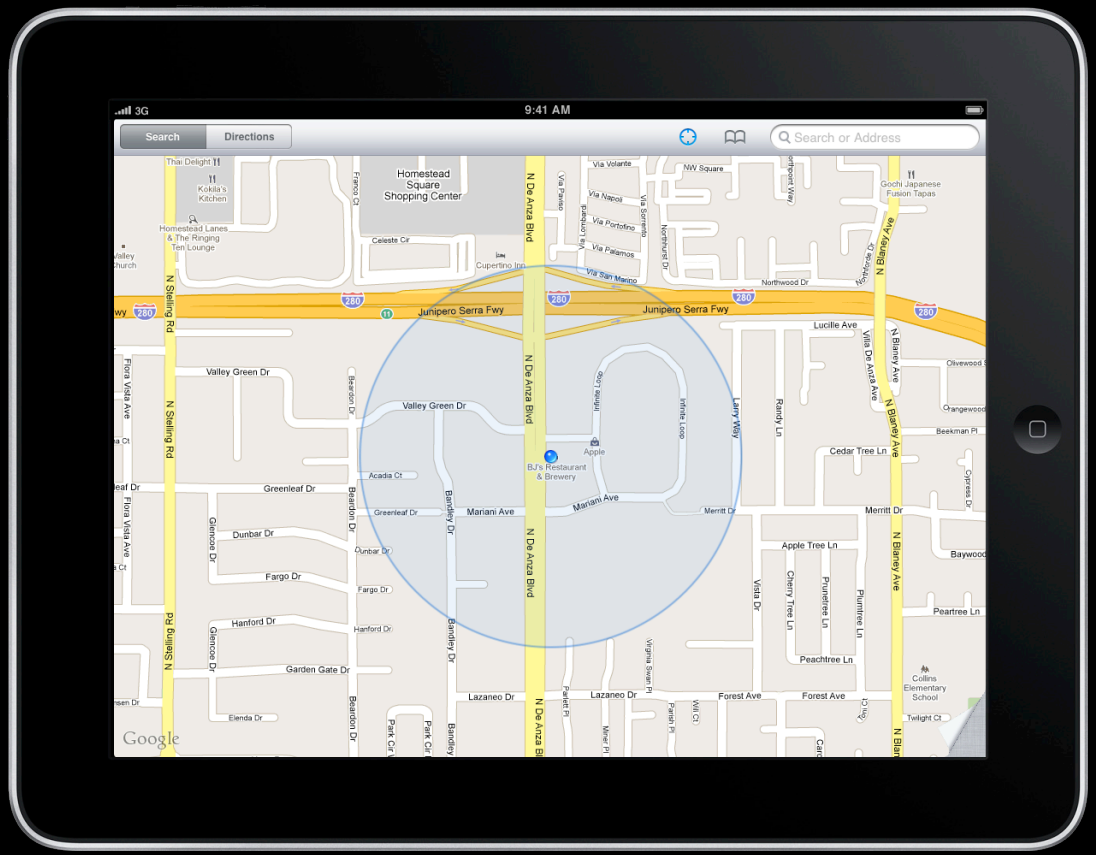


Cell

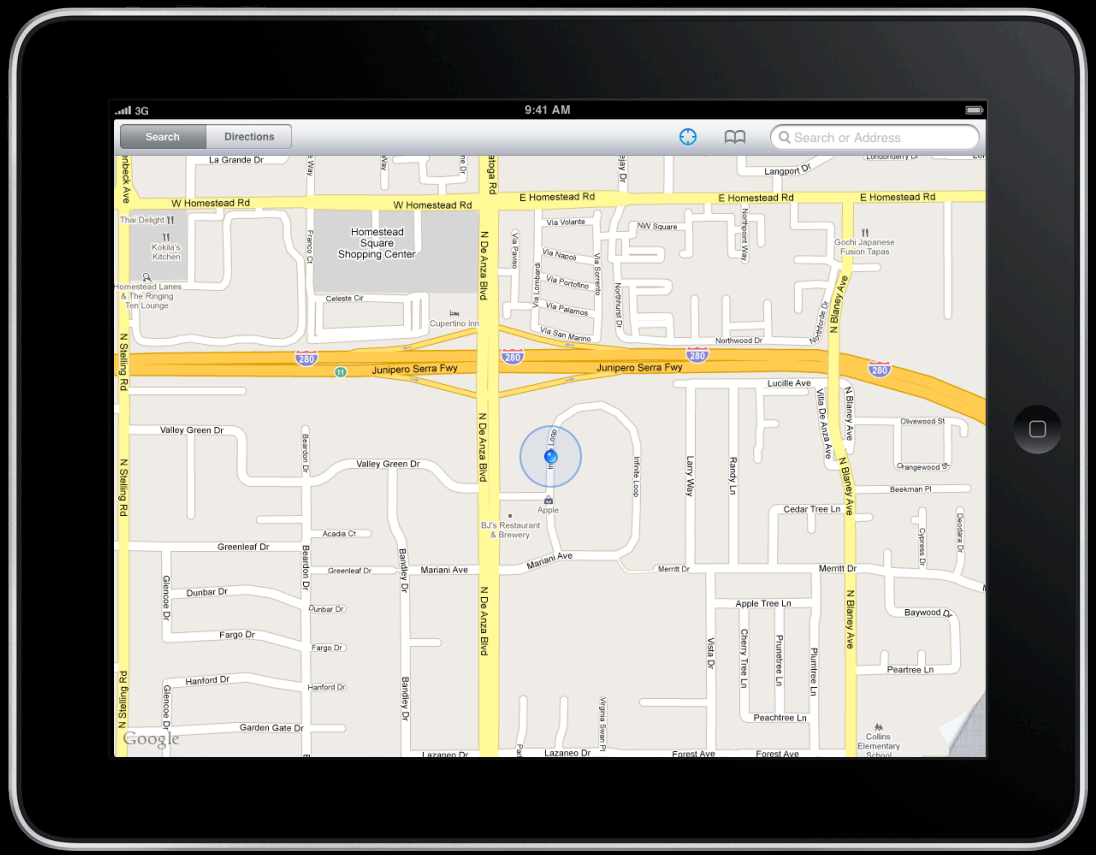
Wi-Fi

GPS

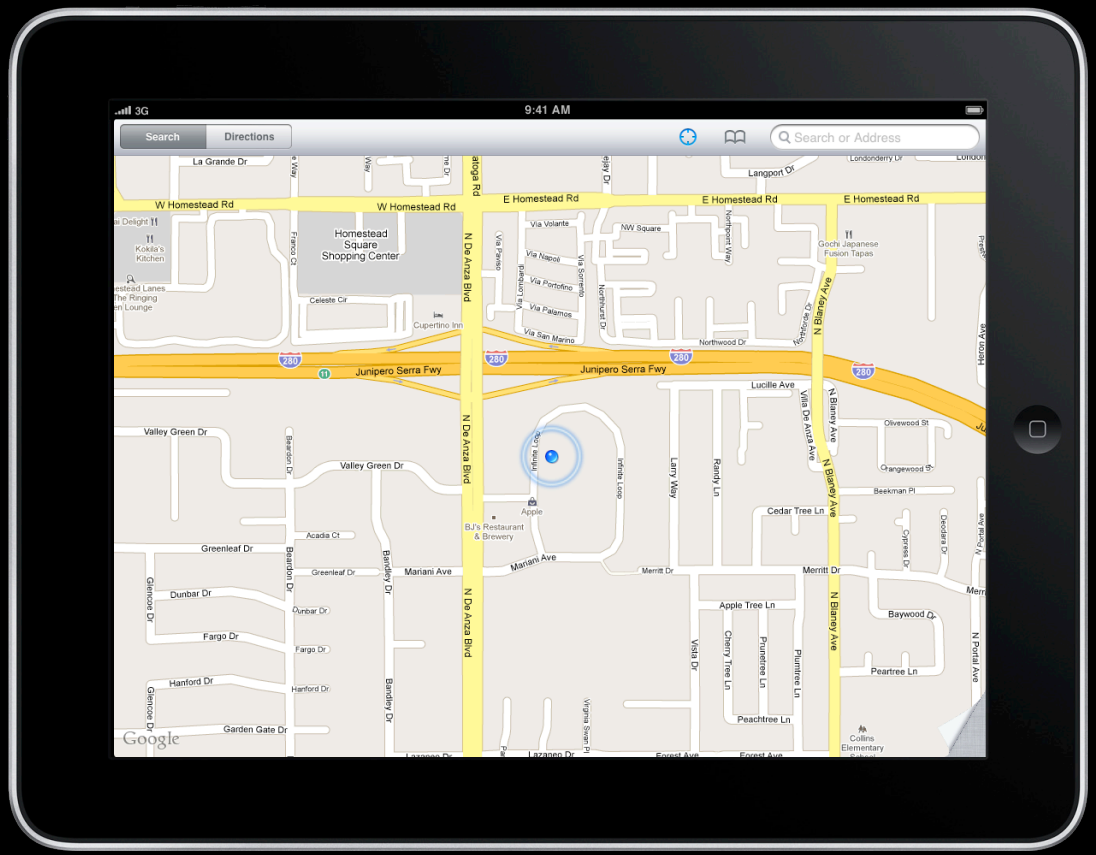
Cell Positioning



Wi-Fi Positioning



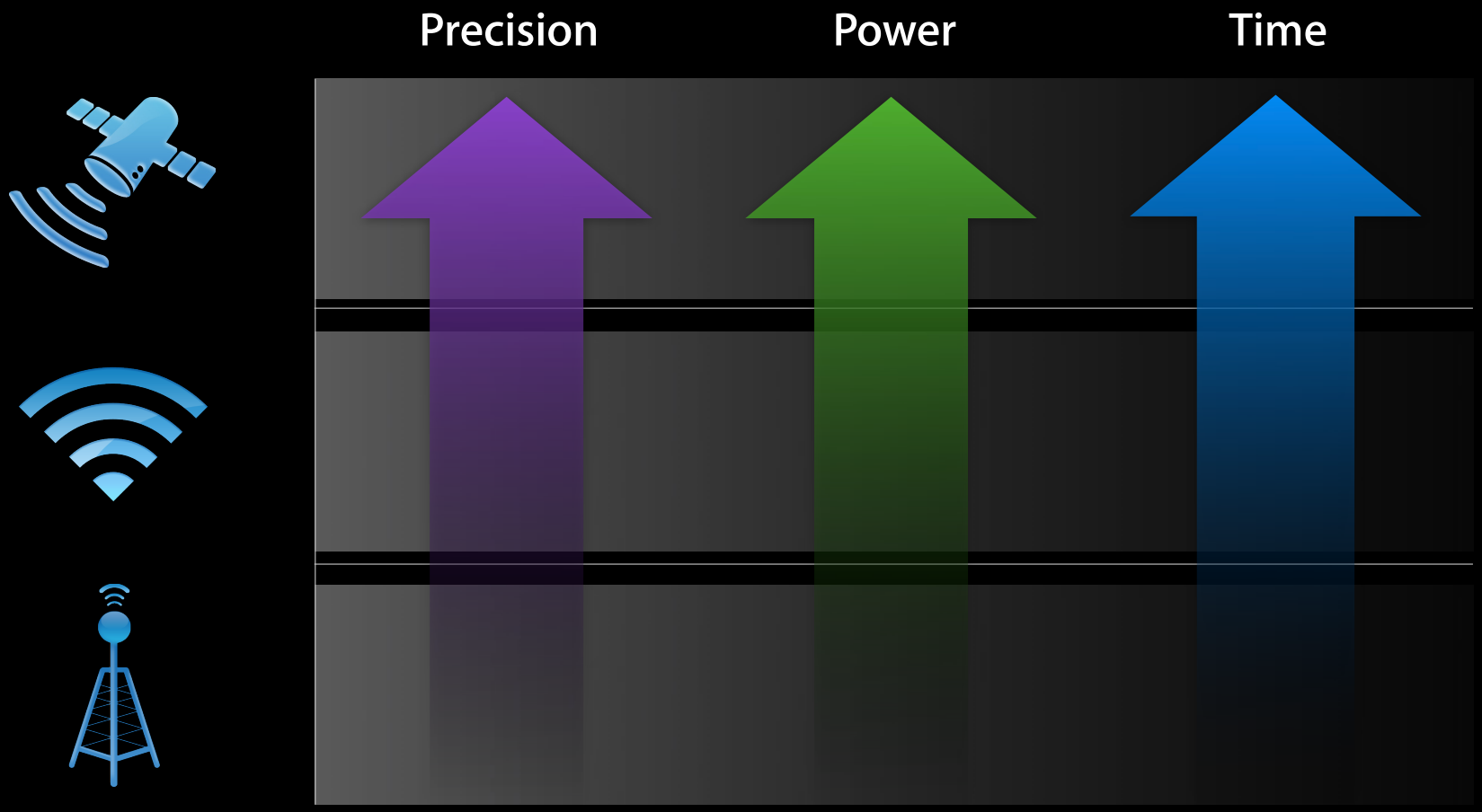
GPS Positioning



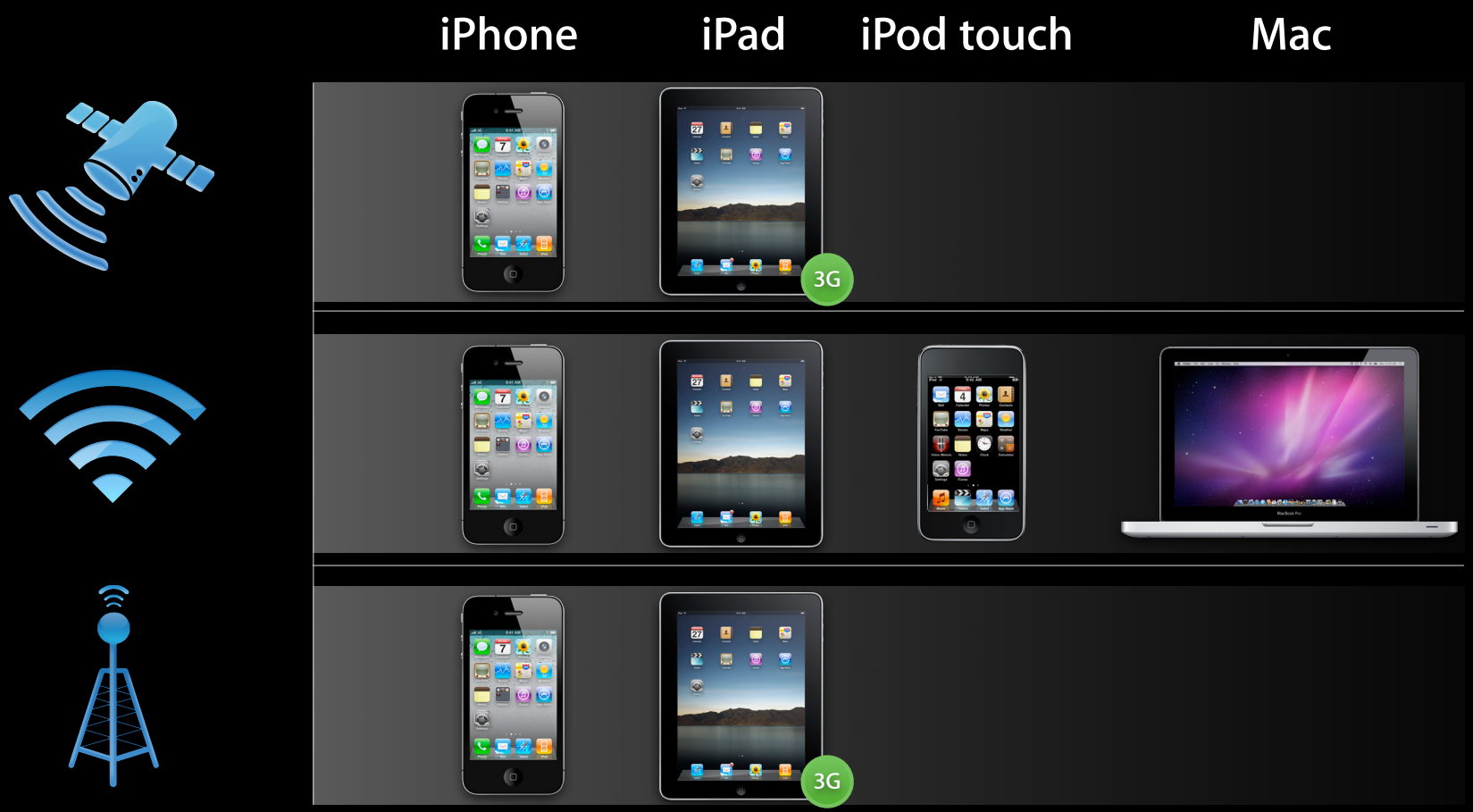
One API

Core Location

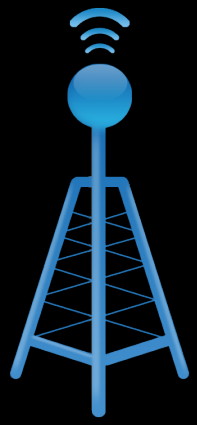
Comparing Positioning Methods



Comparing Positioning Methods



Three Positioning Methods

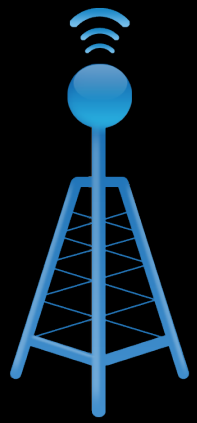


Cell

Wi-Fi

GPS

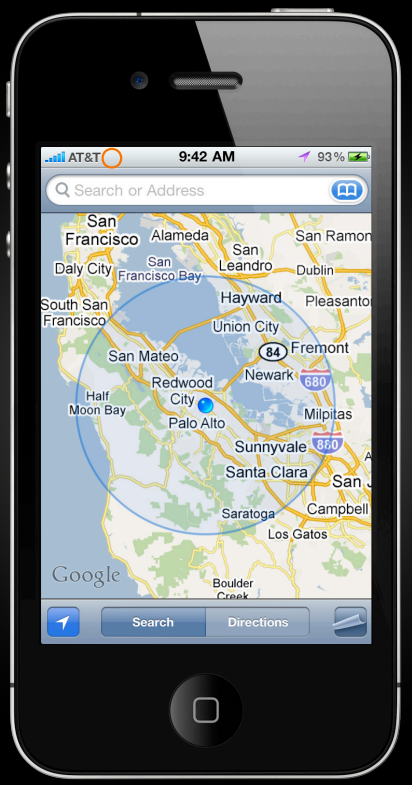
Three Positioning Methods



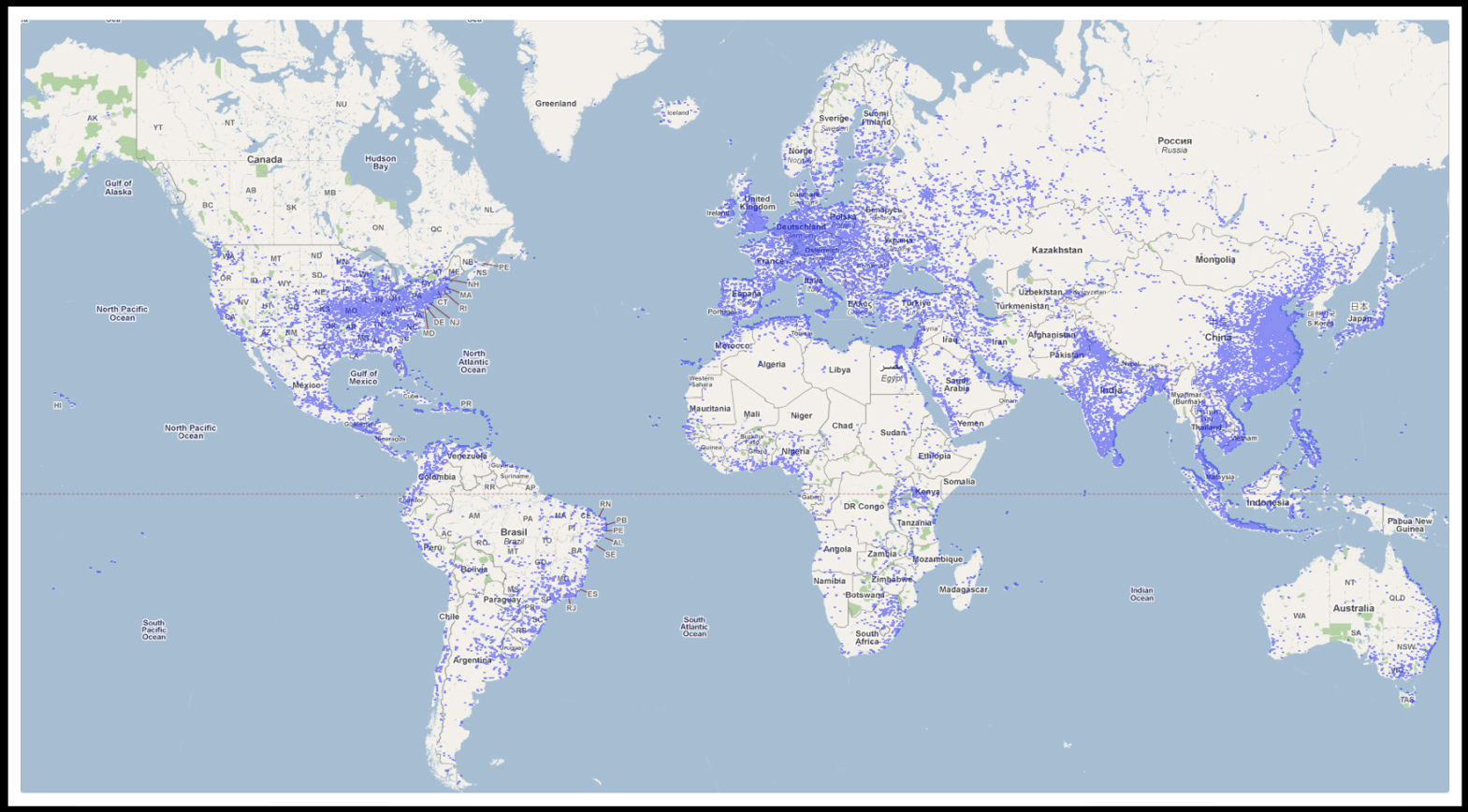
Cell

Coarse Cell Positioning

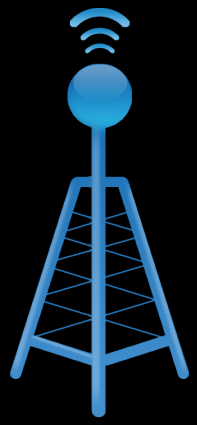
- Locate the user even without a data connection
- Accurate to 10–50 kilometers



Coarse Cell Positioning Coverage



Three Positioning Methods



Cell

Wi-Fi

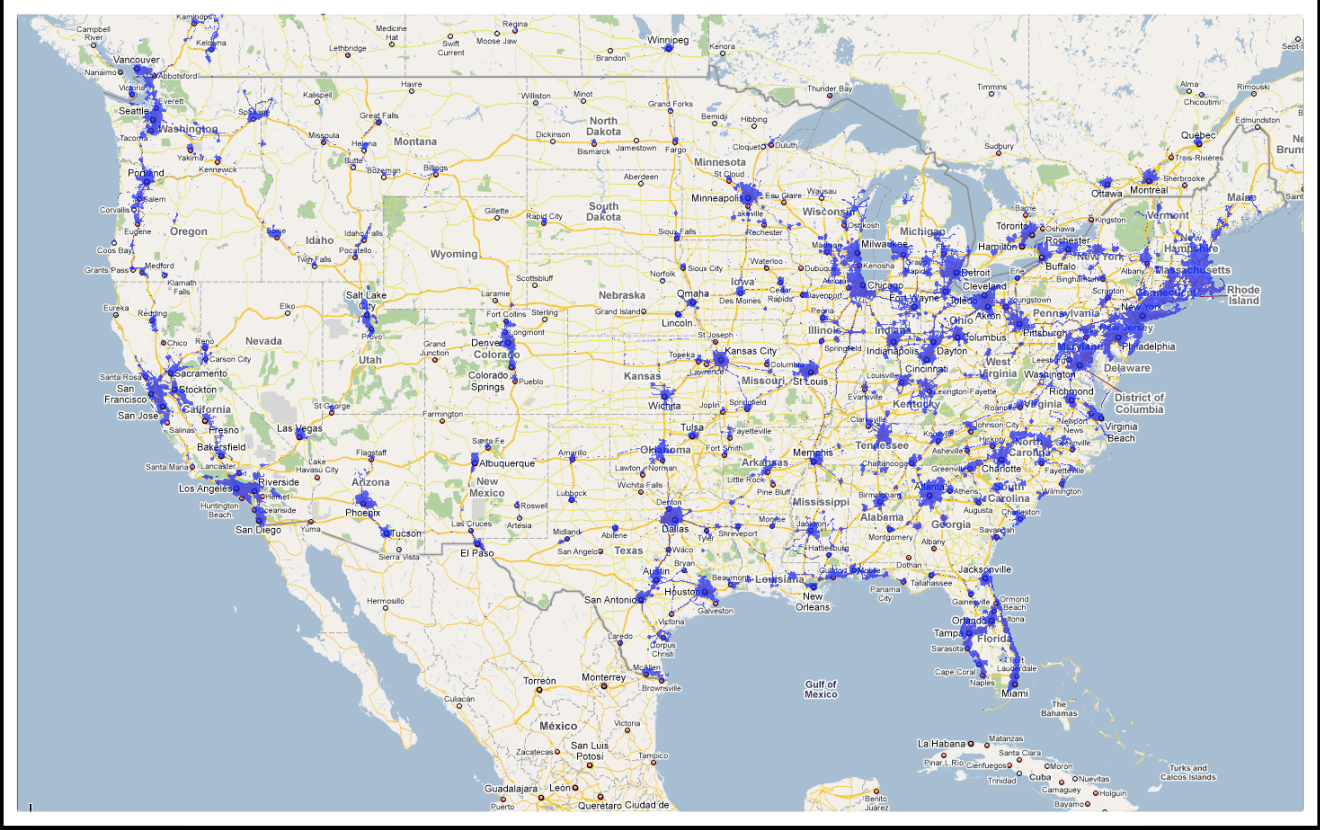
GPS

Three Positioning Methods

Wi-Fi

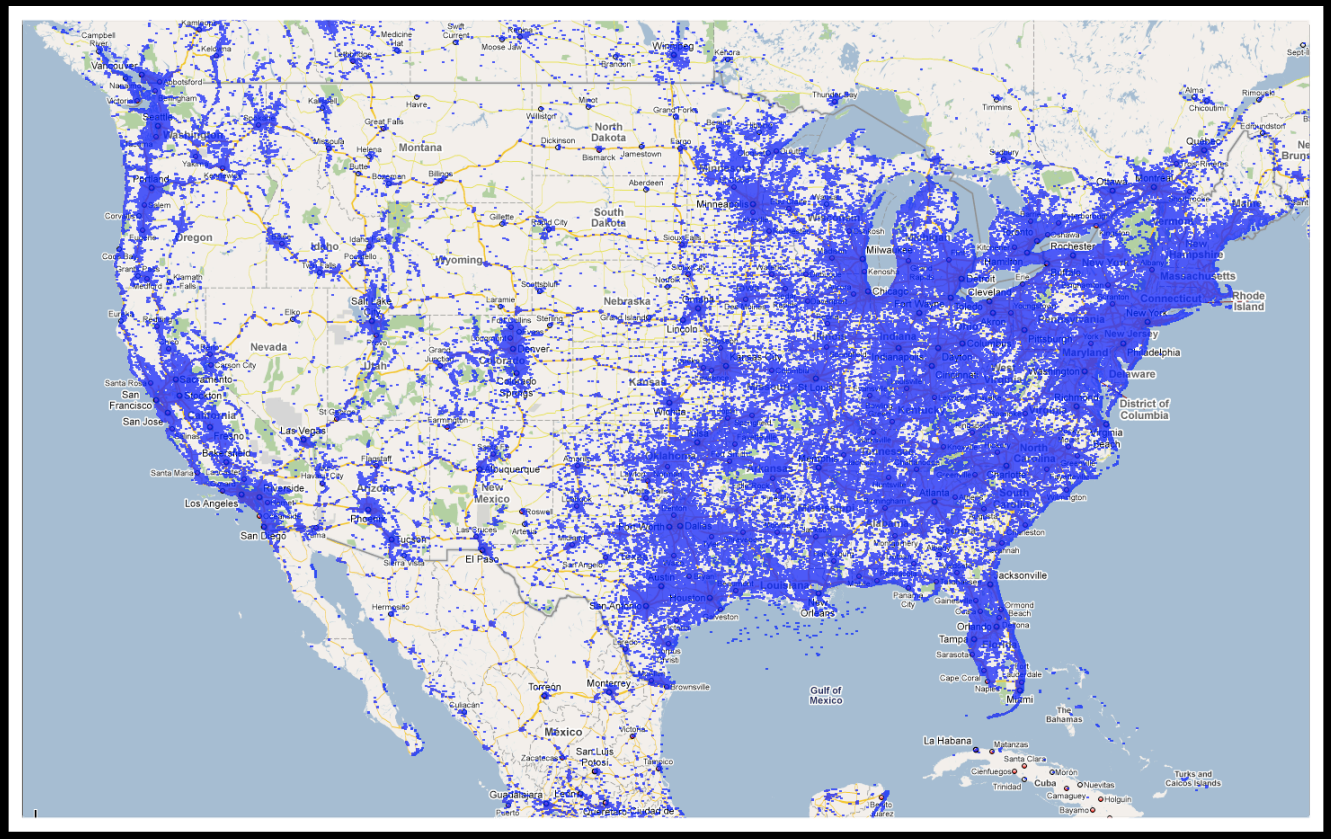
Wi-Fi Location Coverage

iPhone OS 3.1



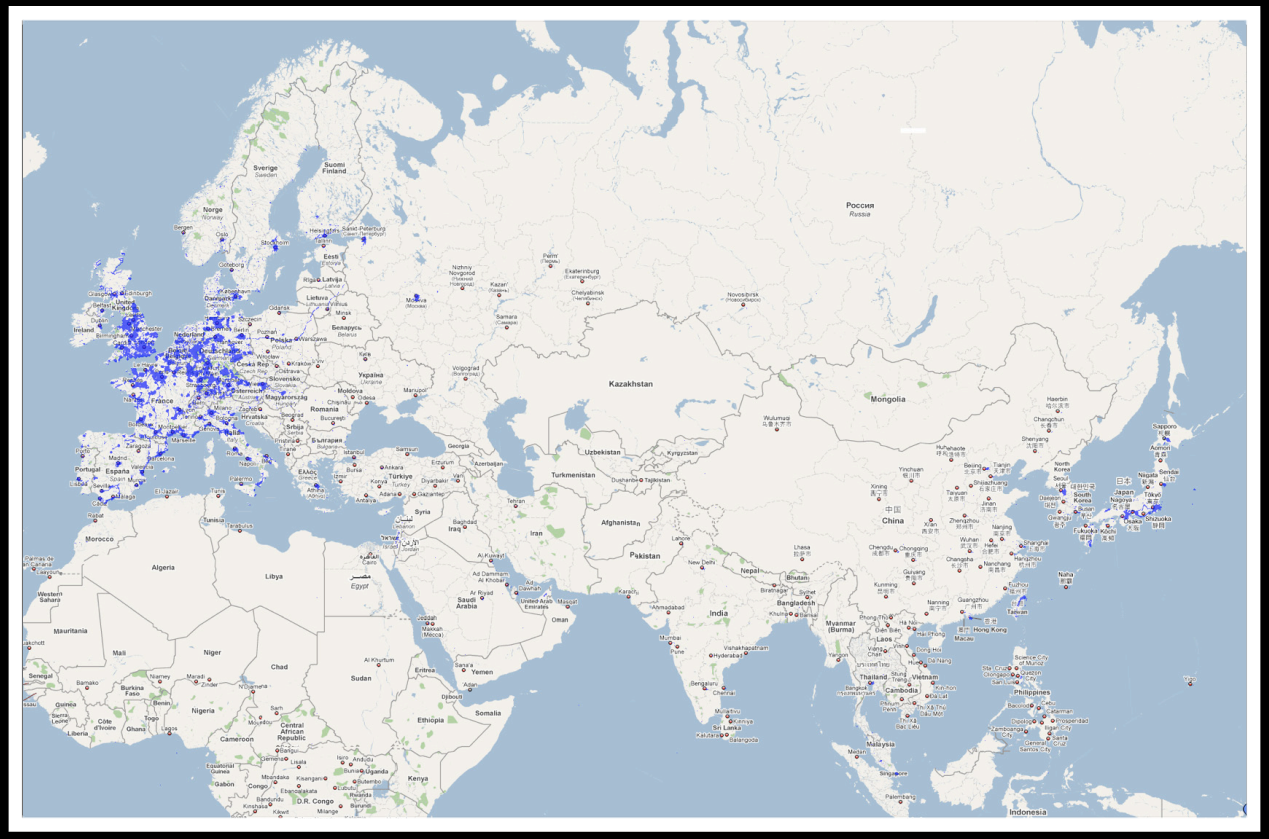
Wi-Fi Location Coverage

iPhone OS 3.2 and iOS 4



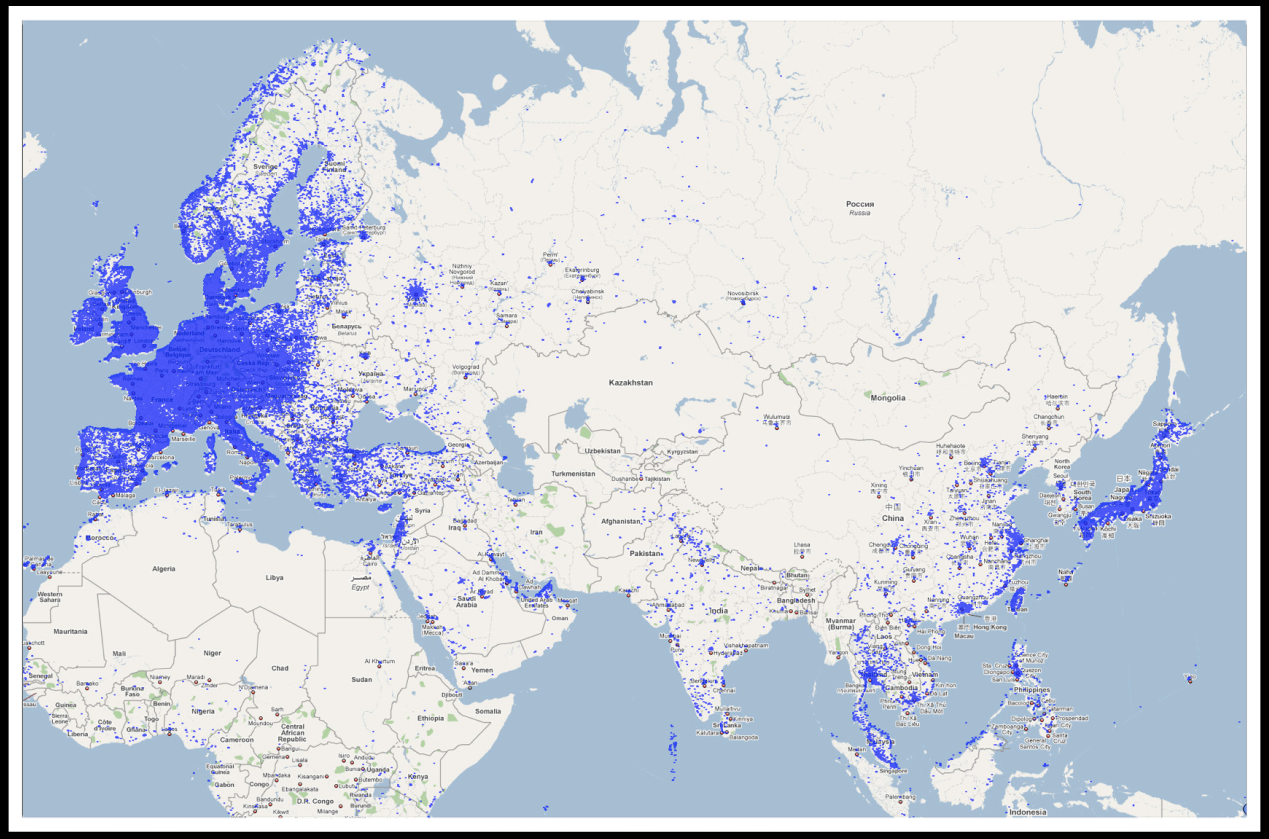
Wi-Fi Location Coverage

iPhone OS 3.1



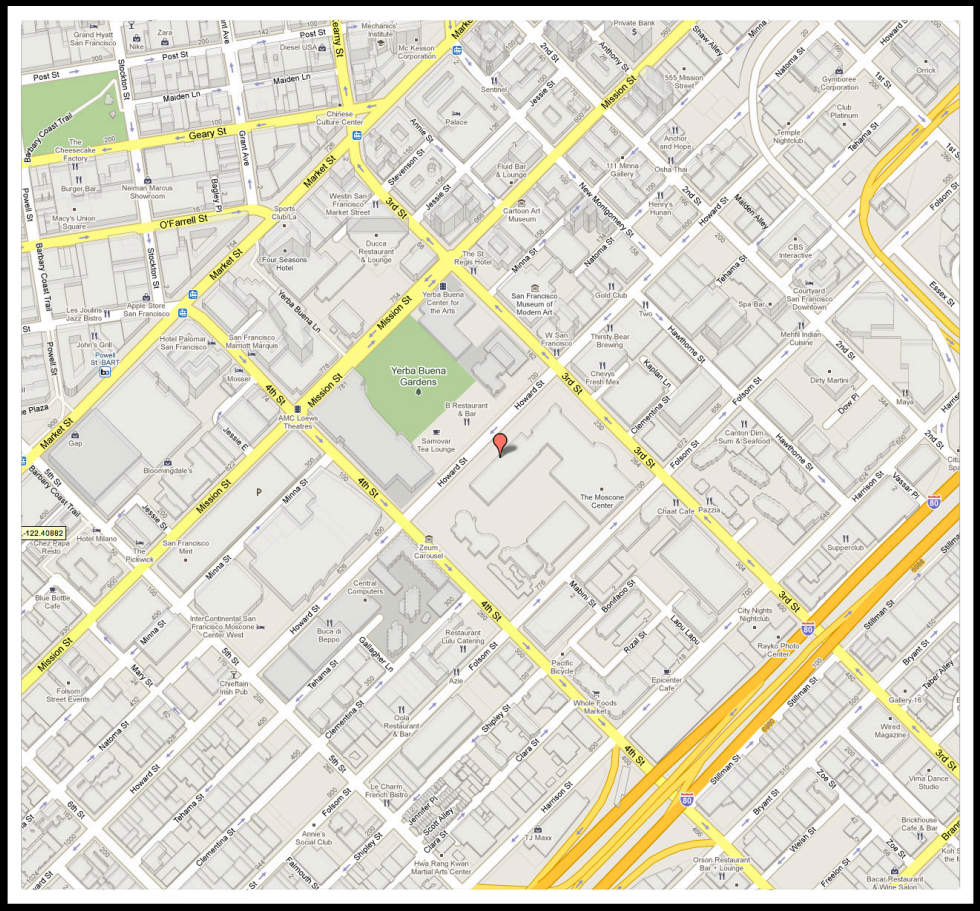
Wi-Fi Location Coverage

iPhone OS 3.2 and iOS 4



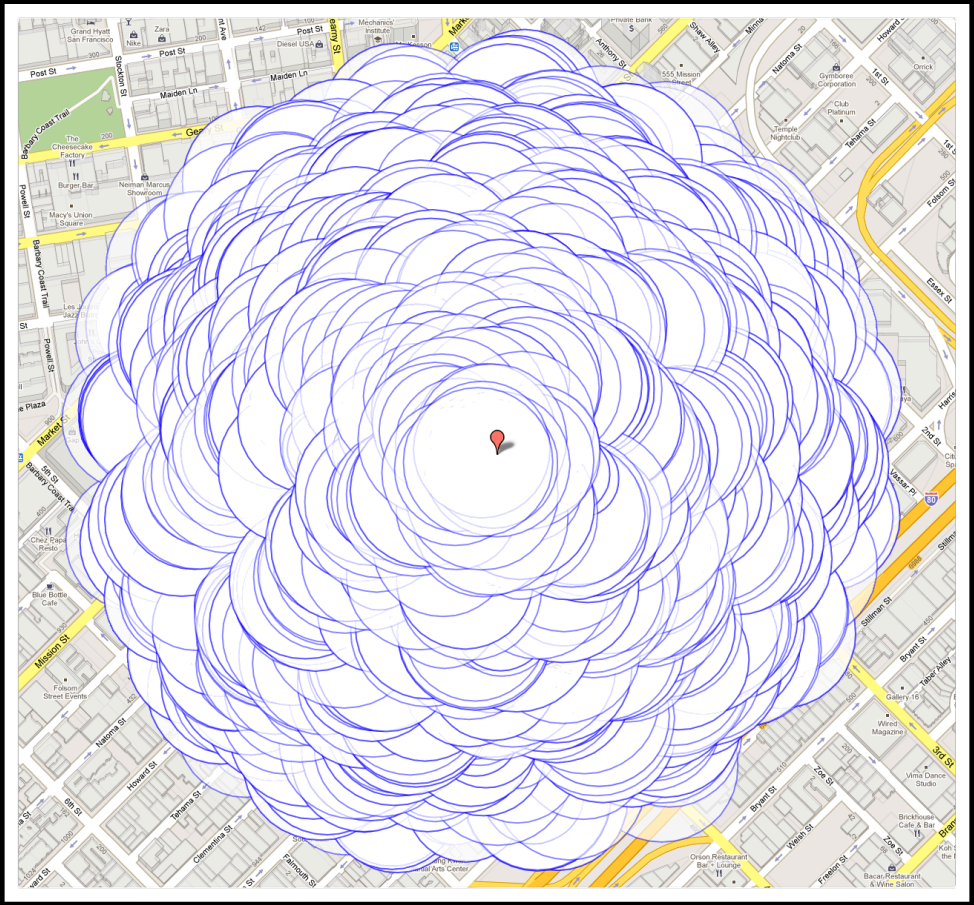
Coarse Wi-Fi Positioning

High-density environment



Coarse Wi-Fi Positioning

High-density environment

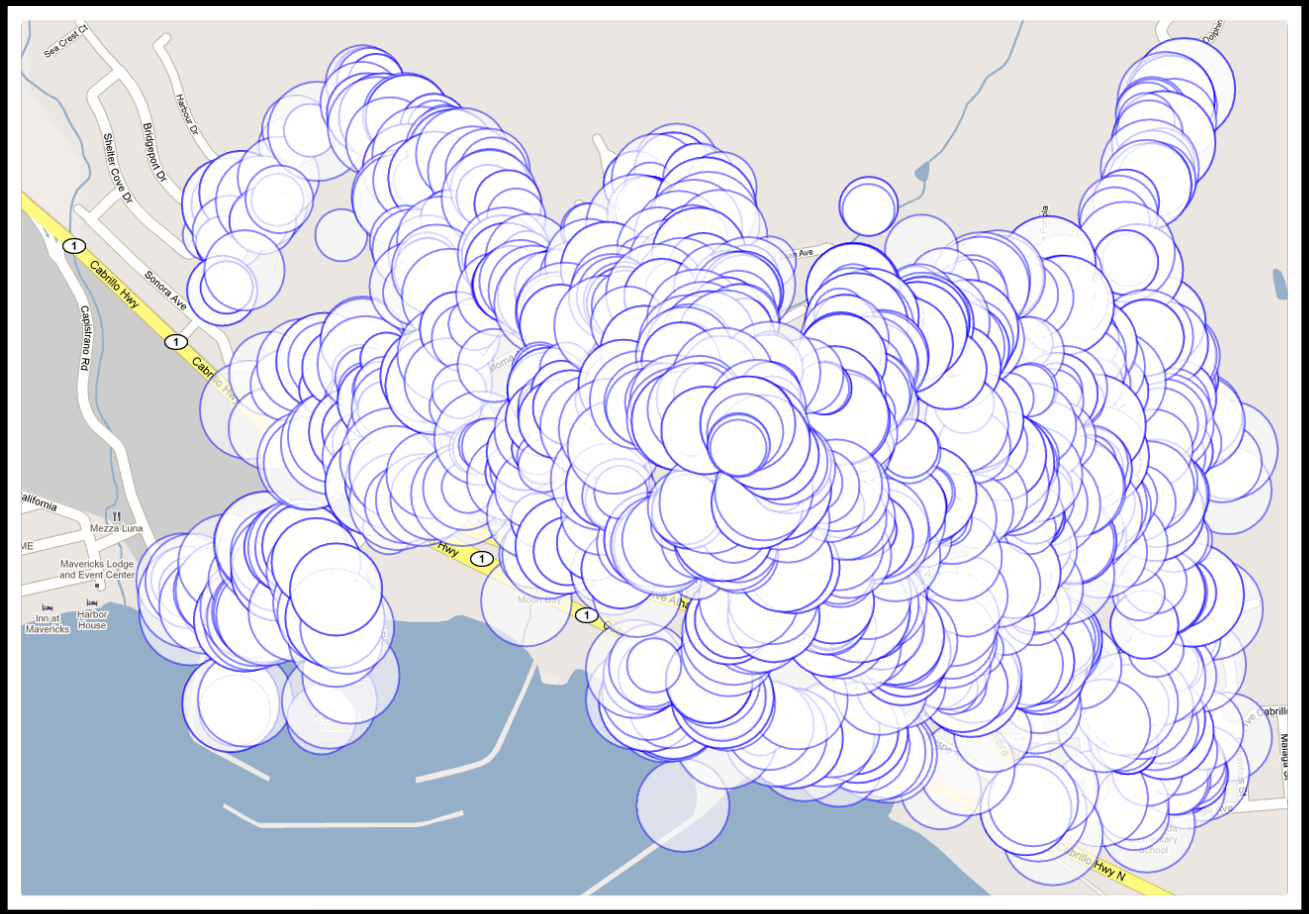


Coarse Wi-Fi Positioning

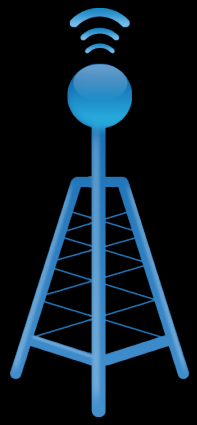
Low-density environment

Coarse Wi-Fi Positioning

Low-density environment



Three Positioning Methods



Cell

Wi-Fi

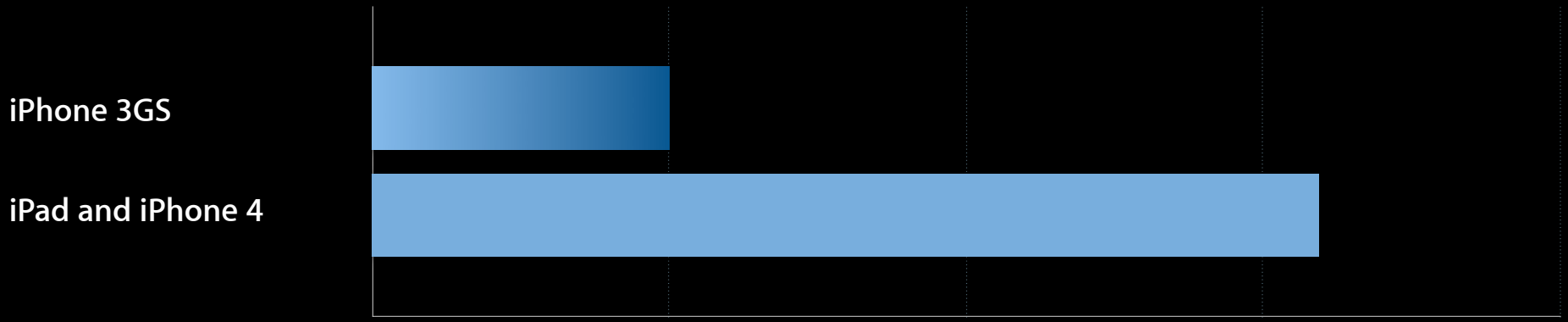
GPS

Three Positioning Methods

GPS

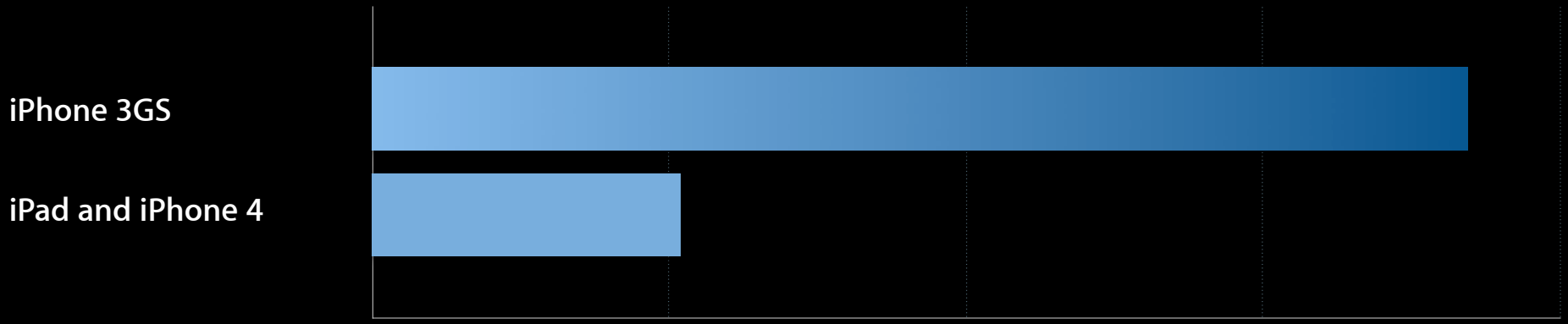
Comparing GPS Performance

Significantly improved accuracy



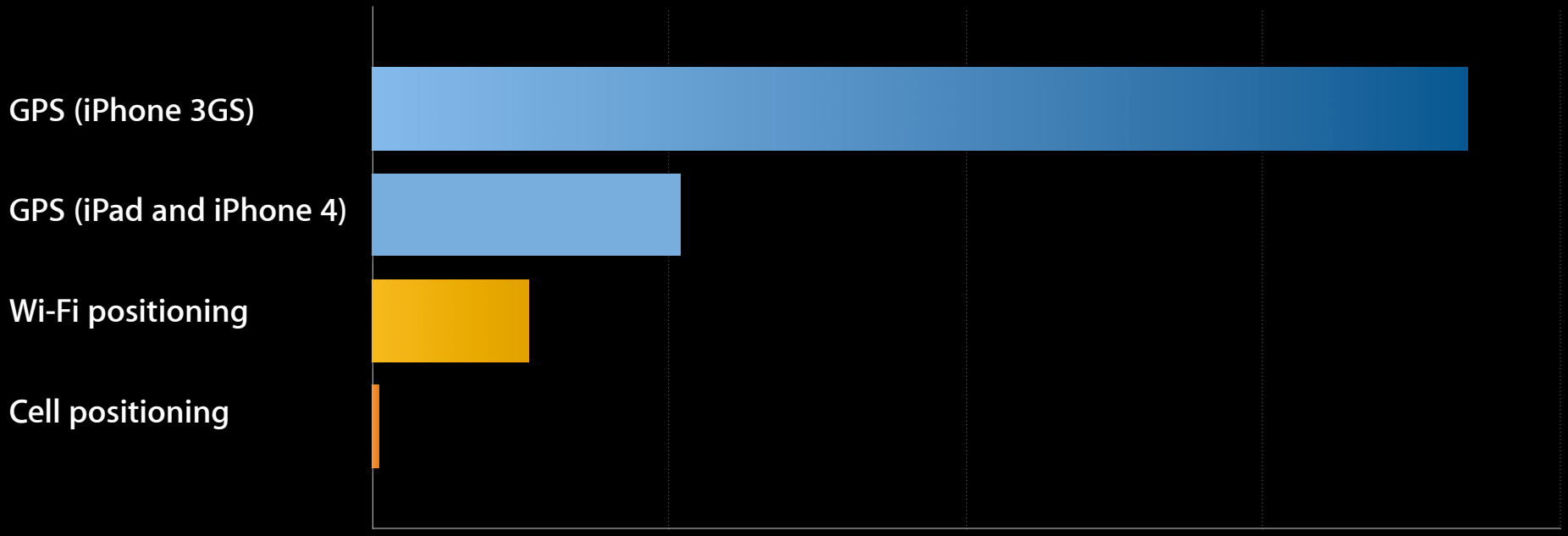
Comparing GPS Performance

Significantly improved power consumption

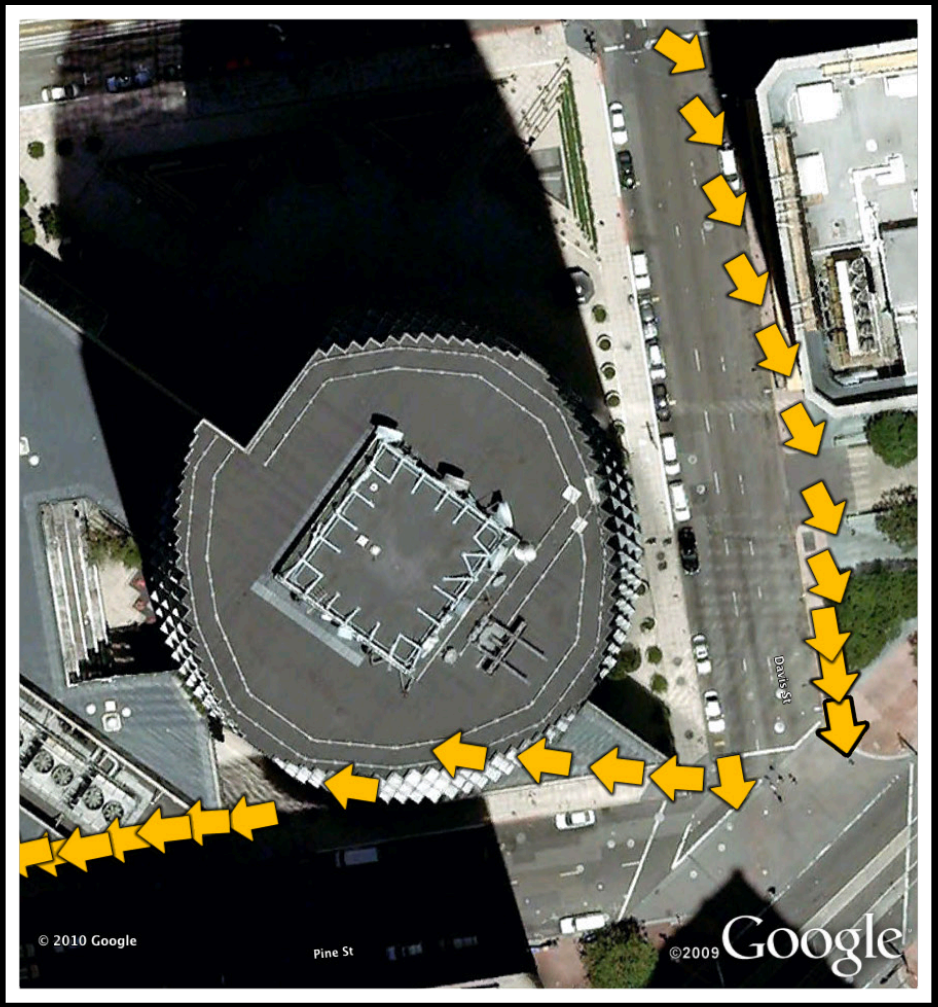


Comparing GPS Performance

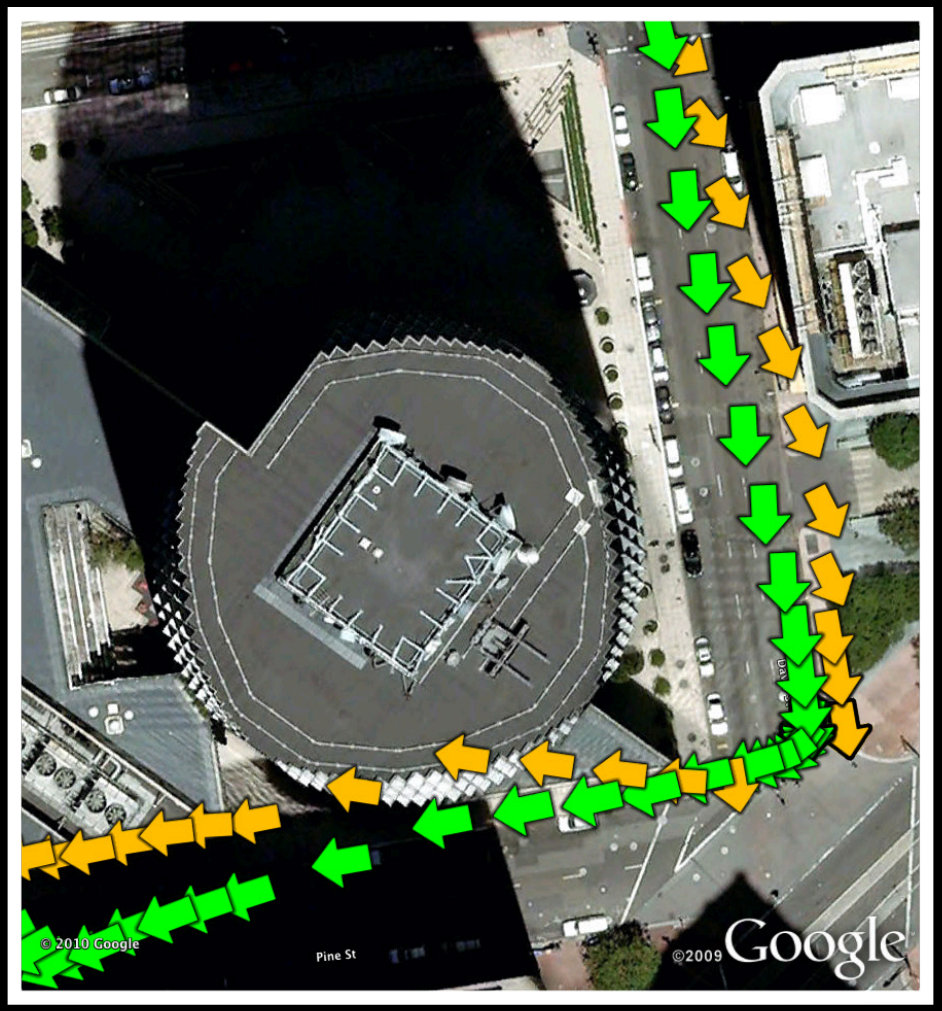
Other technologies



Improvements for Navigation

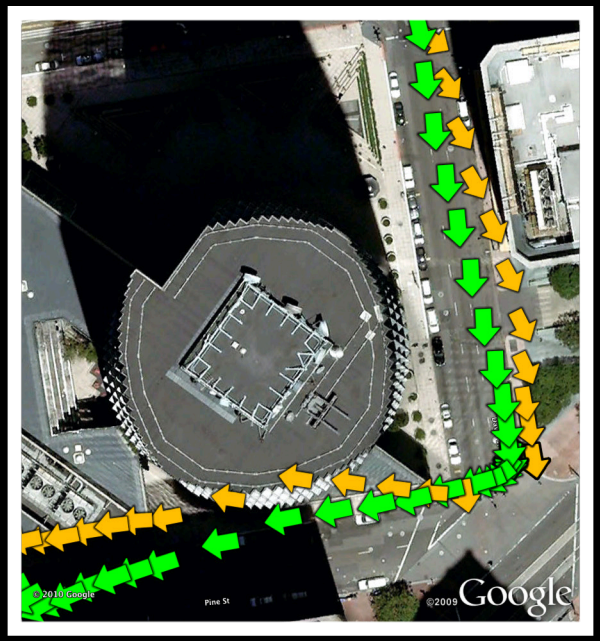


Improvements for Navigation



Improvements for Navigation

- Improves GPS via sensor aiding
- Additional CPU and power cost
- Useful primarily for vehicular navigation



The Core Location Framework

How do you use it?

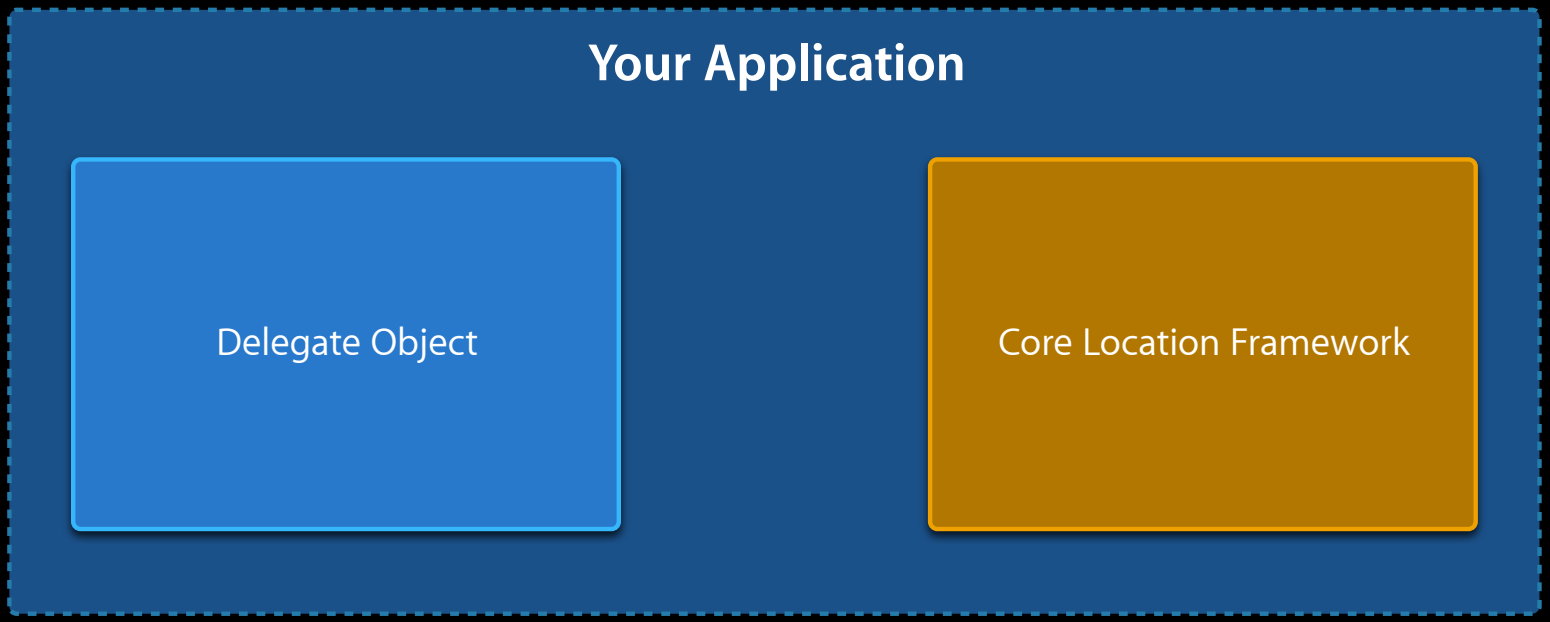
The Core Location Framework

Agenda

- Primary components
- Requesting and receiving location updates
- Configuring the location manager
- Handling errors
- User authorization
- Best practices

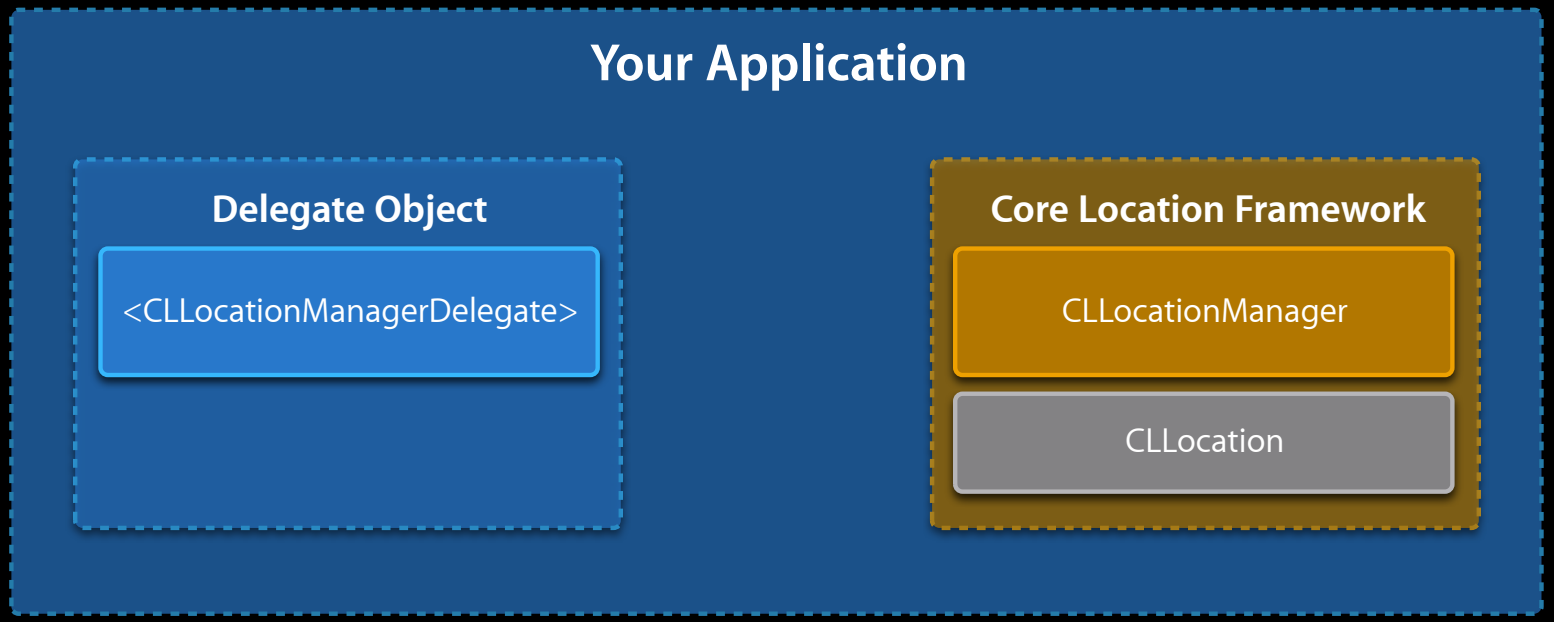
Core Location Architecture

Primary components



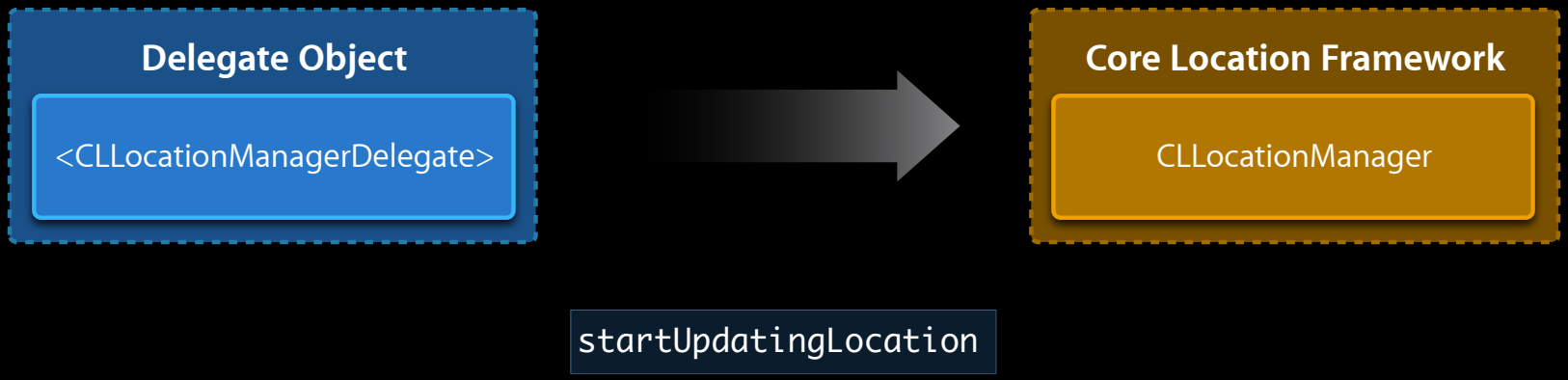
Core Location Architecture

Primary components



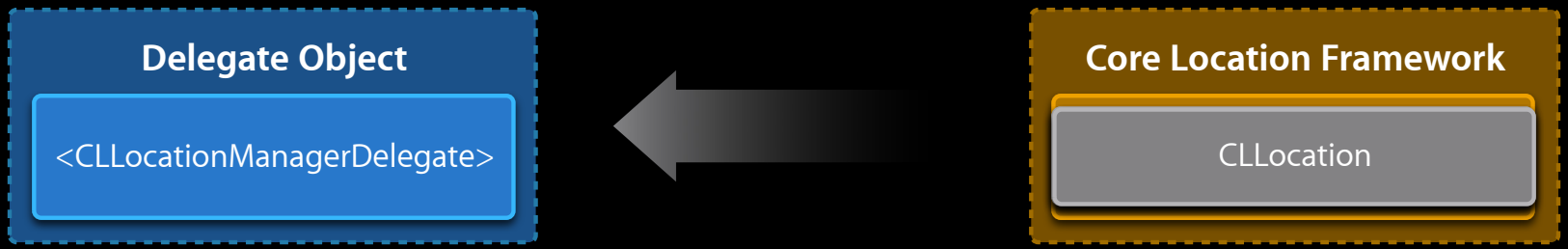
Using Core Location

Starting location updates



Using Core Location

Receiving location updates

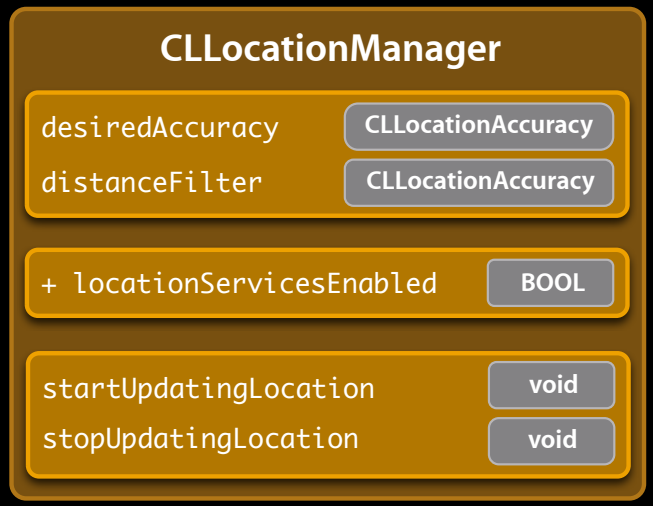



```
locationManager:didUpdateToLocation:fromLocation:
```

Using Core Location

Configuring the location manager

- Specify the accuracy you require
- Distance filter prevents unneeded callbacks
- Check if location services are enabled



Using Core Location

Handling errors

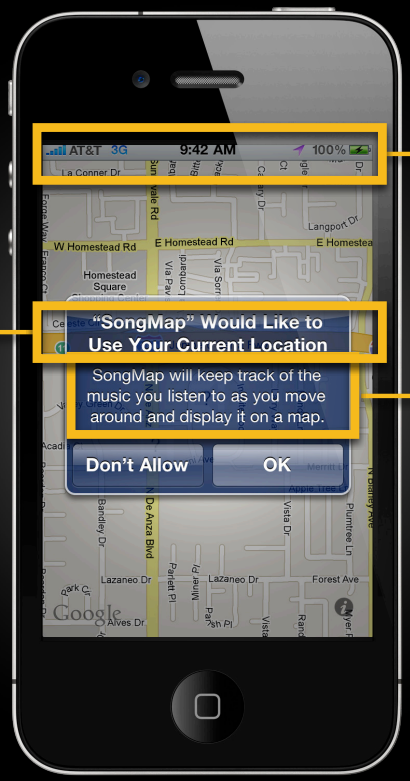
Error Code	Description
kCLErrorLocationUnknown	Device is in an area where location cannot be determined (temporary error)
kCLErrorDenied	User denied location services authorization

```
locationManager:didFailWithError:
```

Authorization

Help the user make an informed decision

iOS 4



Status bar icon
Visible when an application is using the user's location

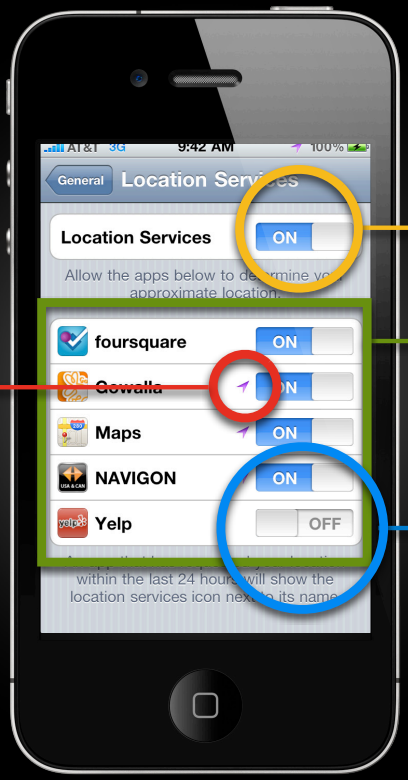
Permission Dialog
Shown once per application; plan for "Don't Allow"

Purpose property
Tell the user why your application needs to use location services

Authorization

The user is in control

iOS 4



Location arrow
Displayed if the application has requested location in the last 24 hours

Enabled switch
Retrieve value from location manager class function

List of applications
Applications appear after requesting location services

Approval switch
Approval status changes will cause kCLErrorDenied

The Core Location Framework

Best practices

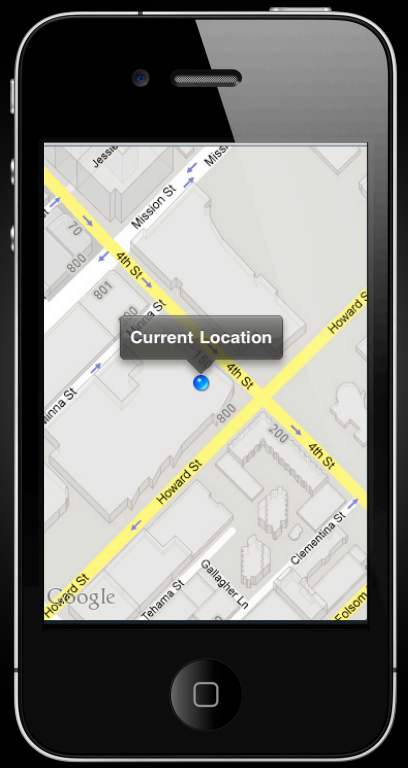
- Some environments make positioning difficult
- Call `stopUpdatingLocation` in response to `kCLErrorLocationUnknown`, and try again later
- Limit the amount of time that you wait for a location with the accuracy you desire

The Core Location Framework

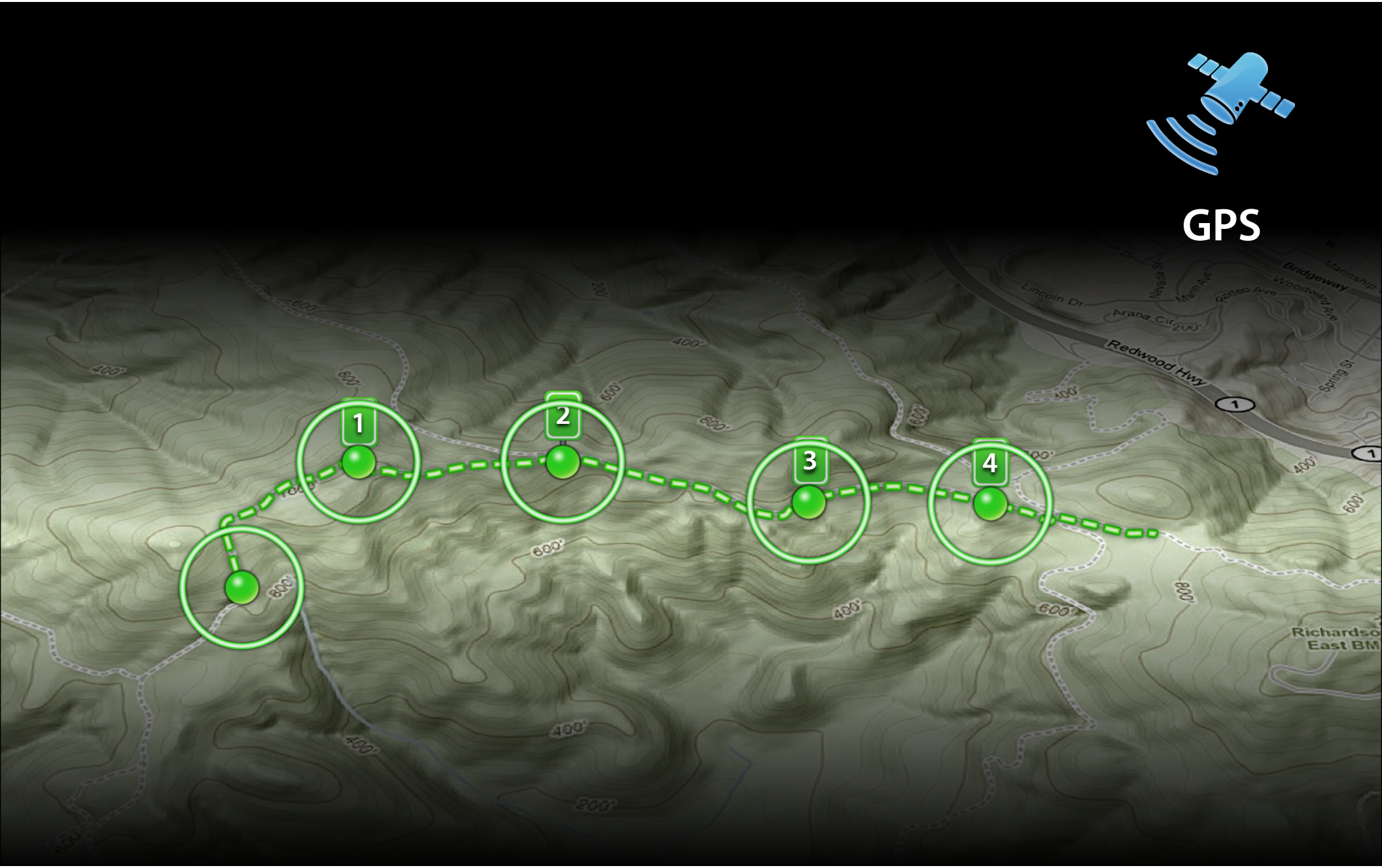
Consider Map Kit

iOS 4

- Allows embedding maps in applications
- Set `showsUserLocation` property
- Uses Core Location
- Customizable



Moving Forward


GPS
1
2
3
4
Redwood Hwy
Lincoln Dr
Bridgeway
Woodward Ave
Spring St
Richardso
East BM

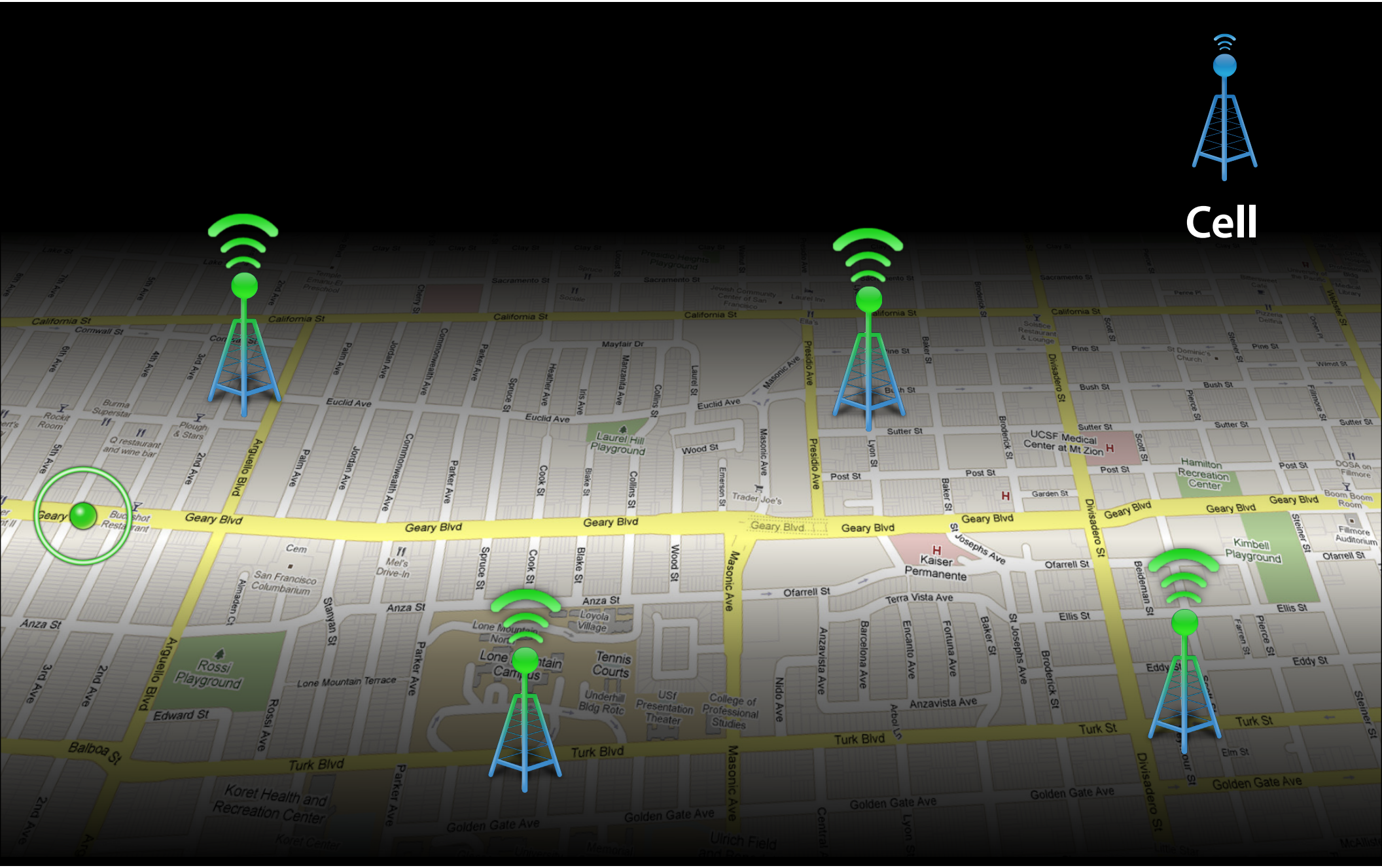
Continuous Location Applications

iOS 4

- User expects the same experience whether or not the application is frontmost
- Declare in Info.plist

```
<key>UIBackgroundModes</key>
<array>
    <string>location</string>
</array>
```

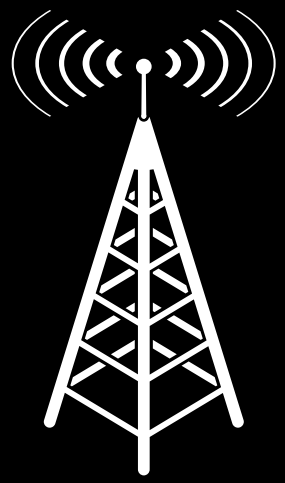

PHOTOS


Cell
Geary
Geary Blvd
California St
Euclid Ave
Arguello Blvd
Masonic Ave
Presidio Ave
Divisadero St
Laurel Hill Playground
UCSF Medical Center at Mt Zion
Hamilton Recreation Center
Kaiser Permanente
Kimbell Playground
Rossi Playground
Tennis Courts
Koret Health and Recreation Center
Ulrich Field
Anza St
Turk Blvd
Golden Gate Ave
Ofarrell St
Ellis St
Eddy St
Turk St
Balboa St
Edward St
Lone Mountain Terrace
Anzavista Ave
Terra Vista Ave
Mayfair Dr
Wood St
Post St
Sutter St
Bush St
Pine St
Sacramento St
Trader Joe's
San Francisco Columbarium
Mel's Drive-In
Loyola Village
USF Presentation Theater
College of Professional Studies
Underhill Bldg Rotc
Buckshot Restaurant
Q restaurant and wine bar
Rockit Room
Burma Superstar
Plough & Stars
Boom Boom Room
DOSA on Fillmore
Fillmore Auditorium

Significant Location Change

iOS 4

- Calculates location when device changes cell towers or when other applications use location services
- Application will be launched in the background if not running
- Accuracy similar to cell positioning



500 – 1000 m

Demo

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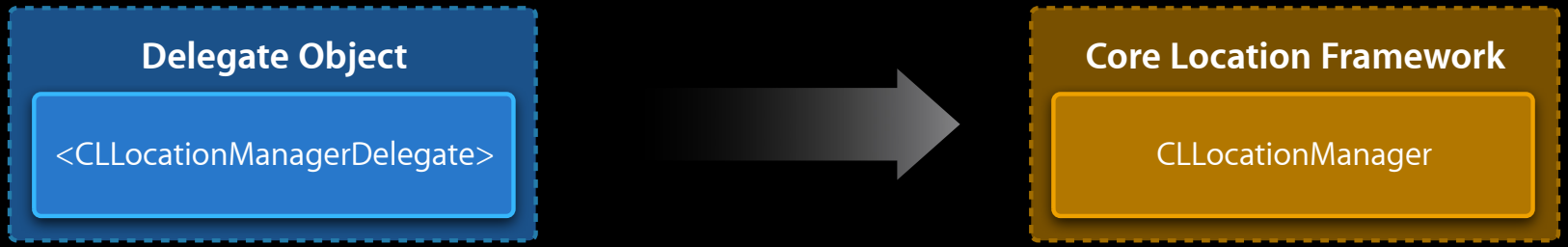
Software Engineer

Significant Location Change Monitoring

iOS 4

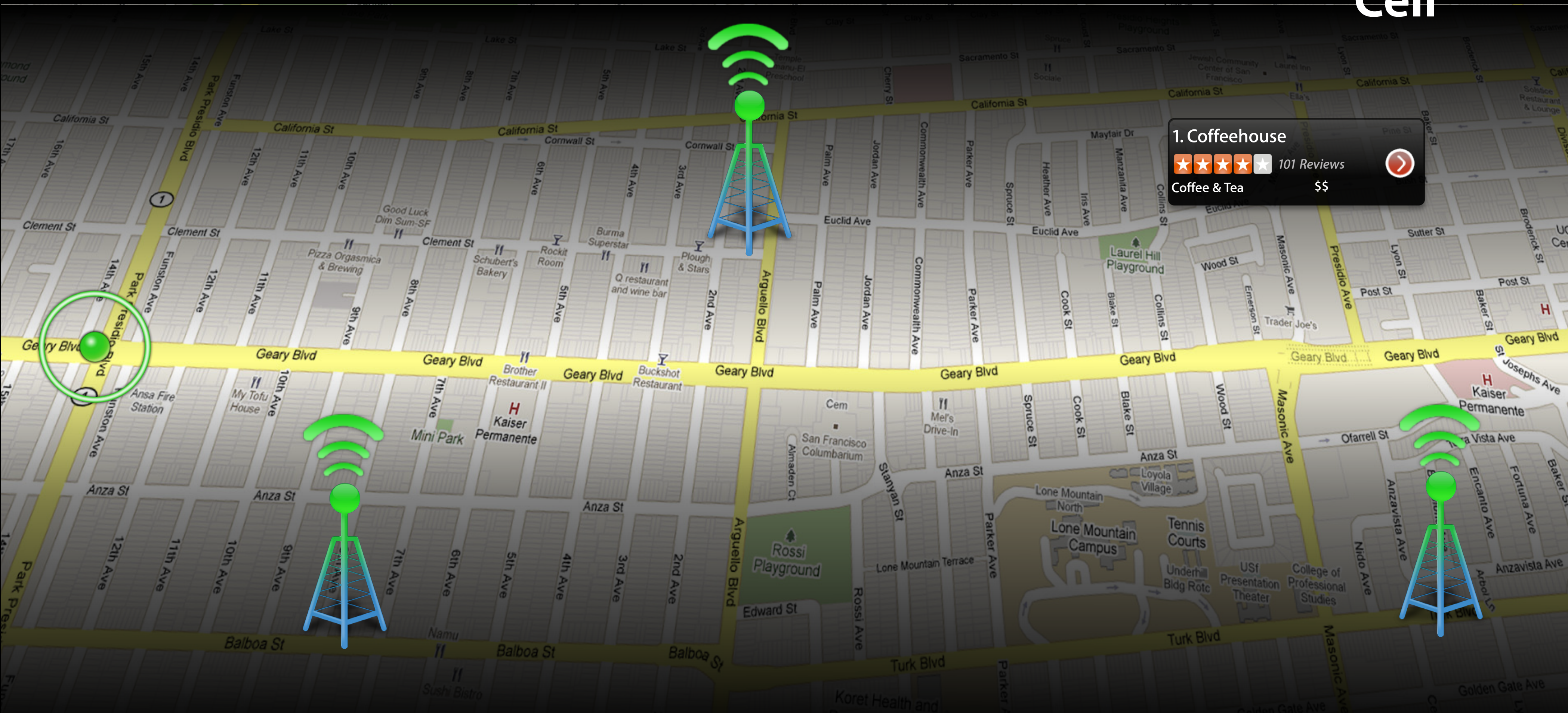



```
startMonitoringSignificantLocationChanges
```

```
locationManager:didUpdateToLocation:fromLocation:
```


7 HR. SERVICE
NO EXTRA CHARGE
LAUNDRY
TAILORING
SHIRTS
DRY CLEANING

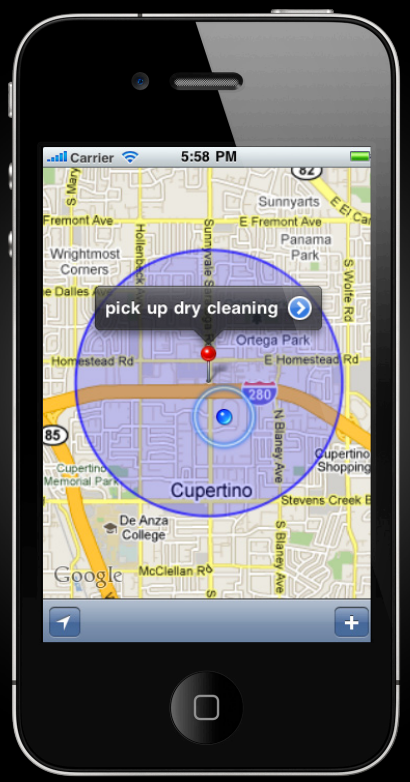
Cell


1. Coffeehouse
101 Reviews
Coffee & Tea
$$
Geary Blvd
California St
Clement St
Anza St
Balboa St
Turk Blvd
Arguello Blvd
Masonic Ave
Presidio Ave
Euclid Ave
Lone Mountain Campus
Laurel Hill Playground
Rossi Playground
Kaiser Permanente
Mini Park

Region Monitoring API

iOS 4

- Register regions surrounding locations of interest
- Notified when user enters or exits region
- Application will be launched in the background if not running
- Based on cell positioning

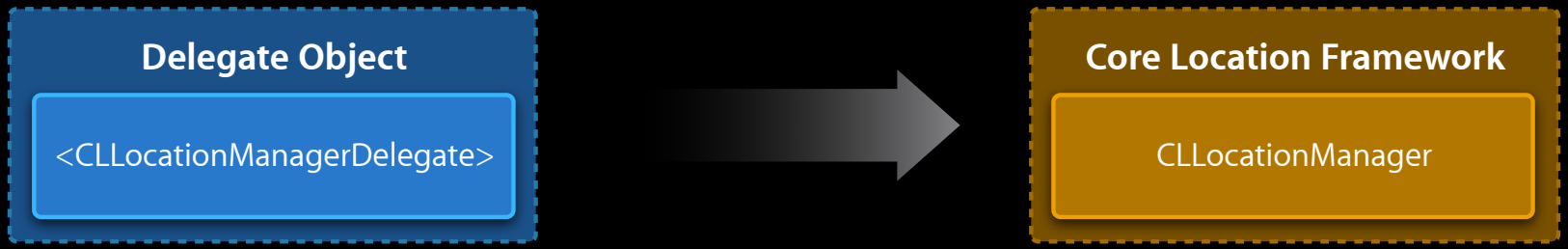


Demo

Jay Bruins
Software Engineer

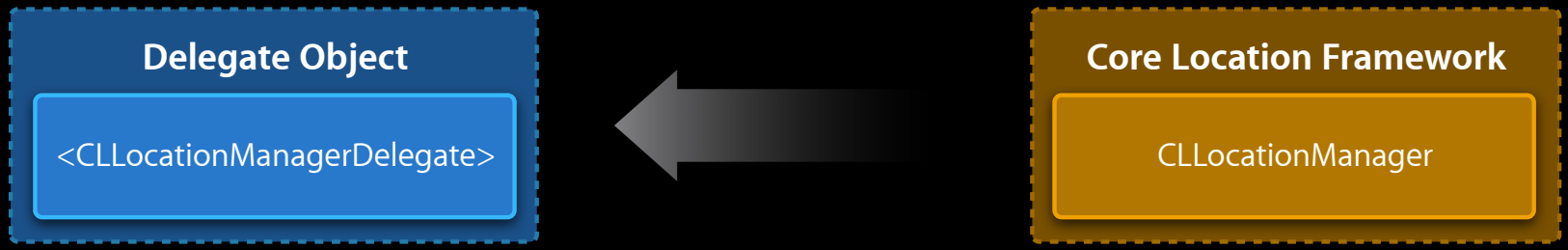
Starting Region Monitoring


```
CLLocationCoordinate2D coord = CLLocationCoordinate2DMake(37.332426, -122.030404);
CLRegion *region = [[CLRegion alloc] initCircularRegionWithCenter:coord
                                                           radius:1000.0
                                                       identifier:@"Apple Inc."];
```




```
startMonitoringForRegion:(CLRegion *)region;
```

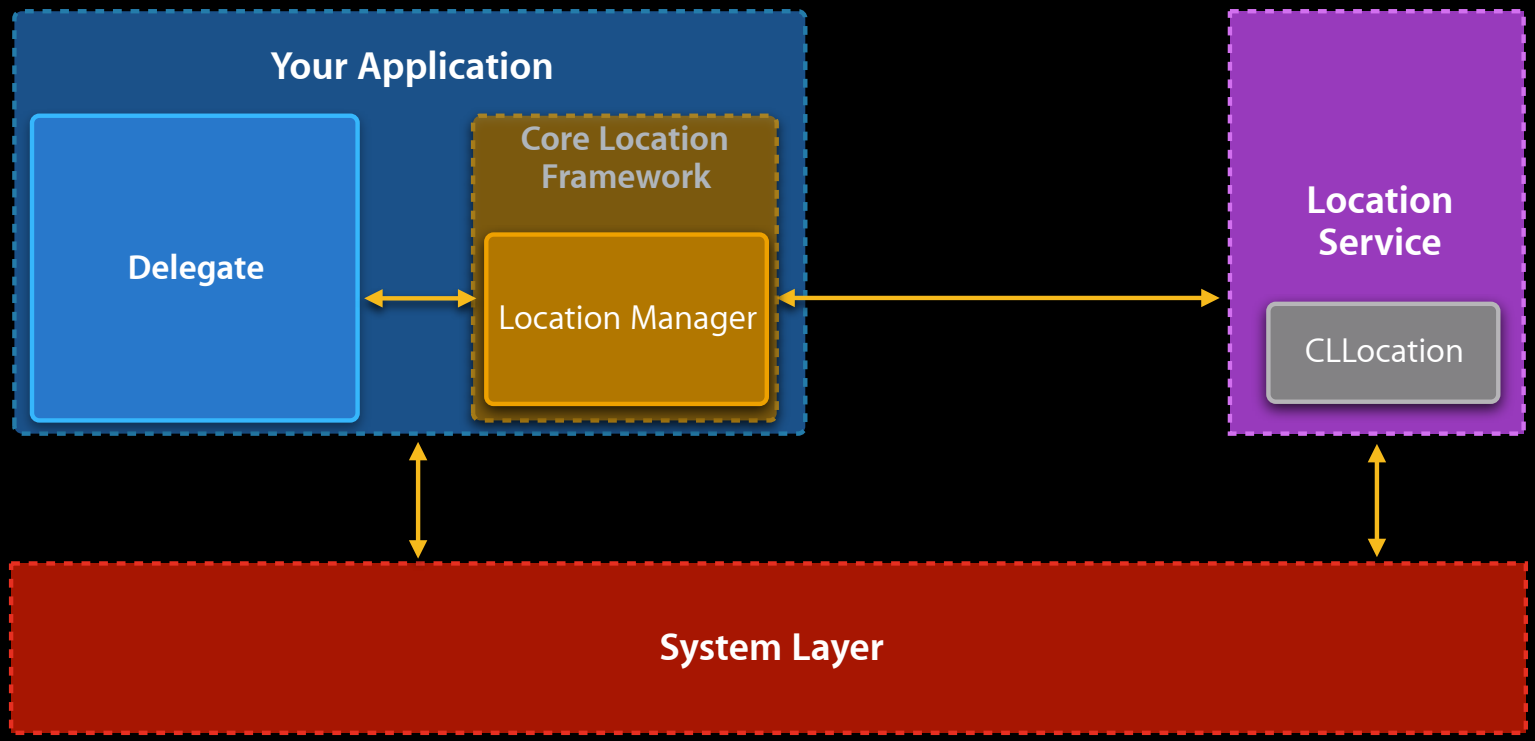
Receiving Region Monitoring Events



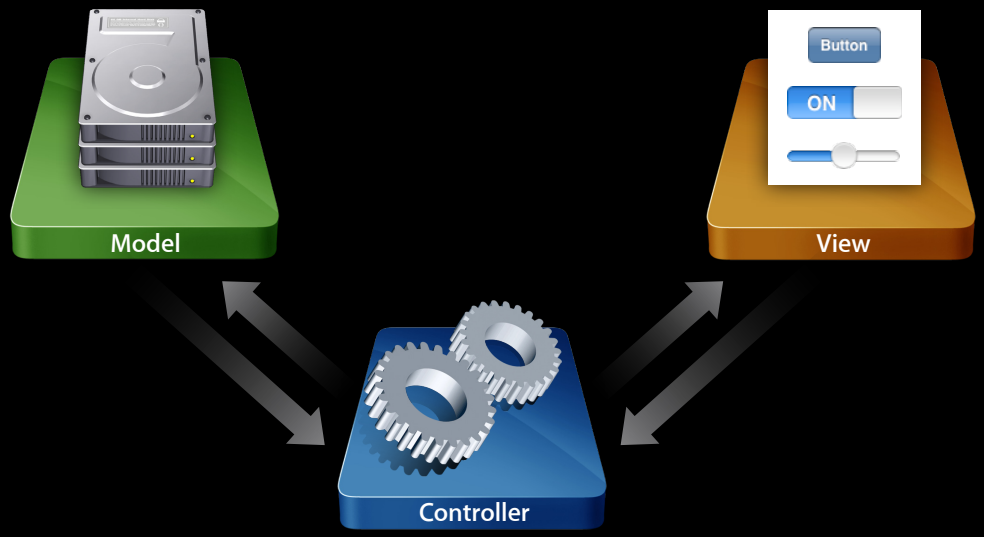

```
locationManager:didEnterRegion:
locationManager:didExitRegion:
```

Launching for Location Events

iOS 4



Model-View-Controller Revisited



Launching for Location Events

Application delegate

```
- (BOOL)application:(UIApplication *)application
  didFinishLaunchingWithOptions:(NSDictionary *)options {

    if ([[options valueForKey:UIApplicationLaunchOptionsLocationKey] boolValue]) {
        NSLog(@"Launched because of location event");
    }

    // Registers for appropriate notifications on initialization if appropriate
    [MyAppLocationController sharedController];

    return YES;
}
```

Launching for Location Events

Application Location Controller

```
- (id)init {

    if (self = [super init]) {
        manager = [[CLLocationManager alloc] init];
        manager.delegate = self;

        if ([NSUserDefaults standardUserDefaults] boolForKey:@”MonitorLocation”]) {
            [manager startMonitoringSignificantLocationChanges];
        }
    }

    return self;
}
```

Summary

- Location provides context
  - Improve the user experience
  - Enable new use cases
- Incredible potential
  - Use the right technology for your use case
  - Surprise and delight your users!

More Information

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Documentation
Core Location Framework Reference
Location Awareness Programming Guide
http://developer.apple.com/iphone

Apple Developer Forums
http://devforums.apple.com

Related Sessions

Sensing Device Motion in iOS 4	Presidio Thursday 10:15AM
Adopting Multitasking on iPhone iOS, Part 1	Marina Friday 9:00AM
Adopting Multitasking on iPhone iOS, Part 2	Marina Friday 10:15AM

Labs

Core Location Lab	Application Frameworks Lab C Wednesday 2:00PM
Map Kit Lab	Application Frameworks Lab B Thursday 2:00PM

Q&A


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