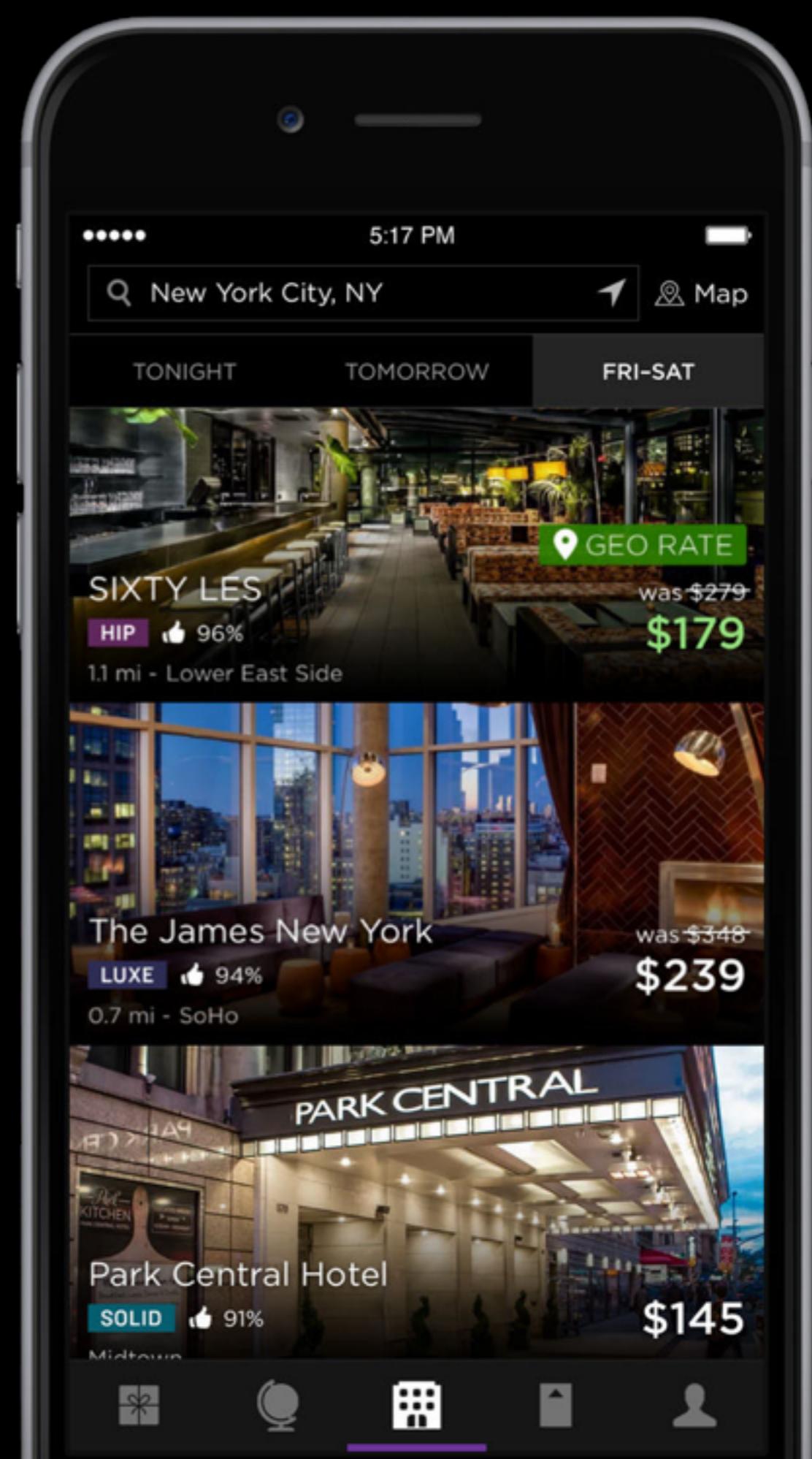


Fun with Instruments

Doug Suriano

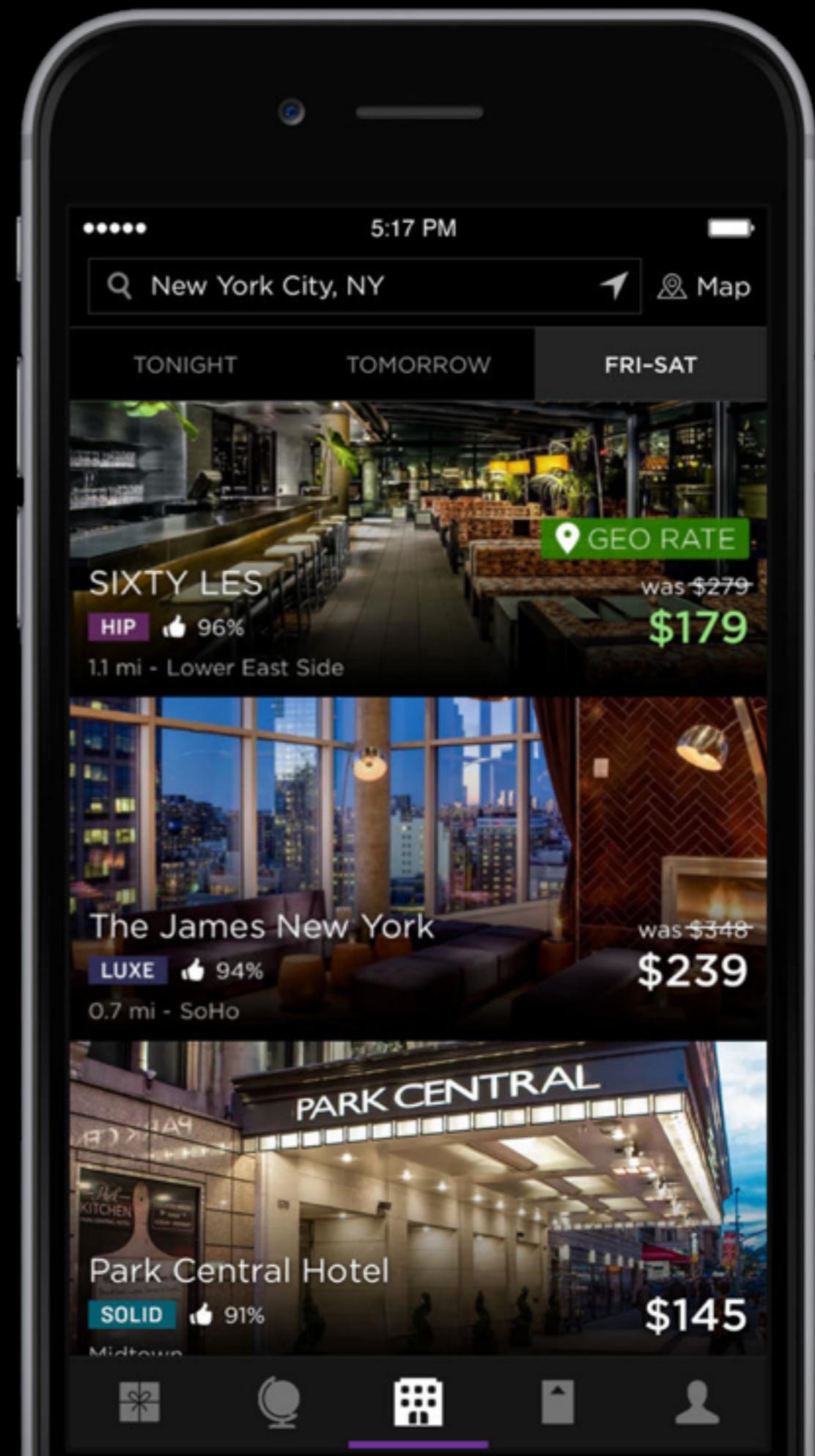
Hotel Tonight

Hotel Tonight



Hotel Tonight

PIZZAPARTY





Profile

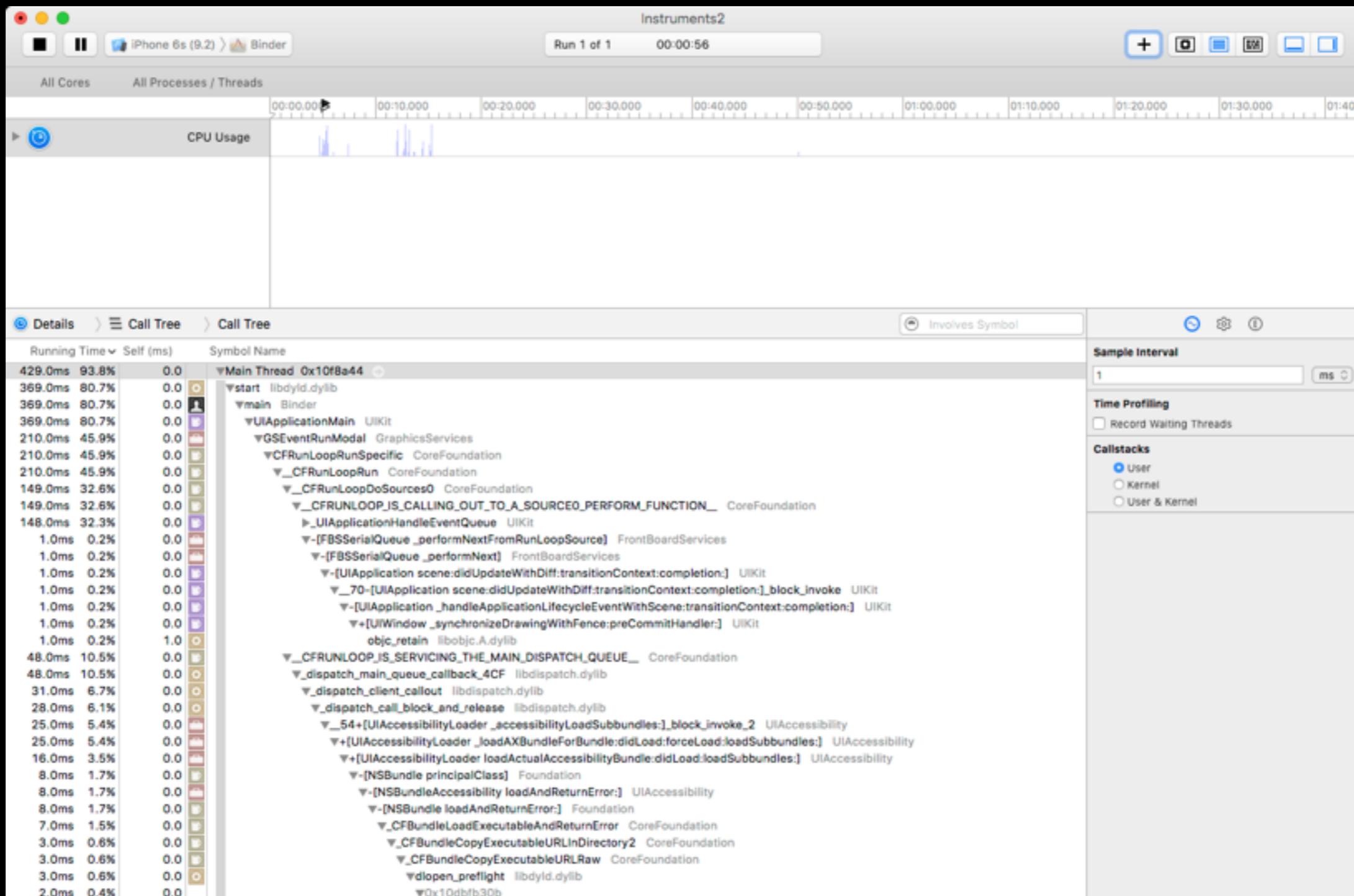
What is profiling?

Run your app.

Run your app.

Instruments Collects Data.

Run your app. Instruments Collects Data.









Core Animation





Allocations



Empty



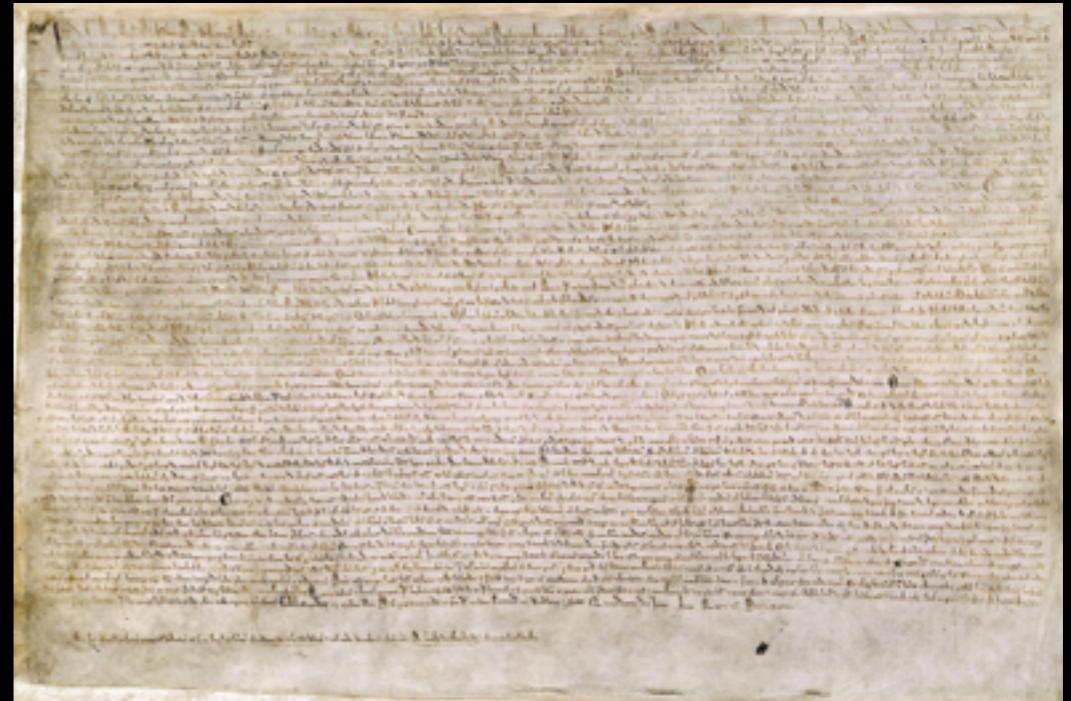


Tonight

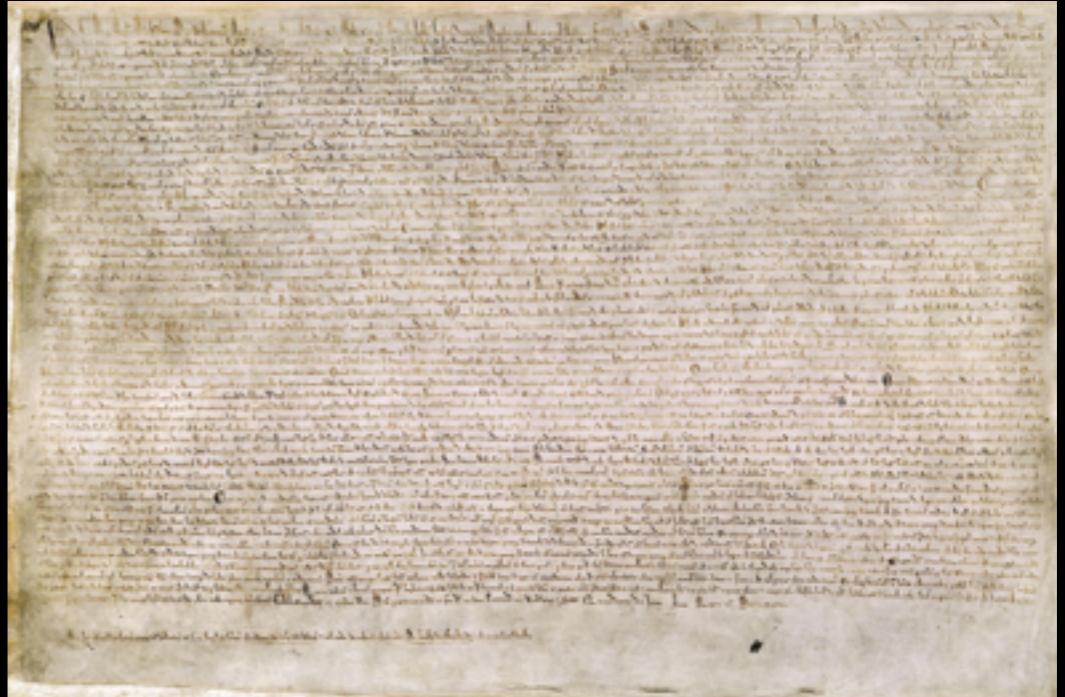
- 3 small apps
- Emphasis on using Instruments to diagnose causes of problems.
- Not a deep dive into the actual problems.
- Demo apps Simple problems with simple solutions (Not the case in real life)

Scrolling Performance

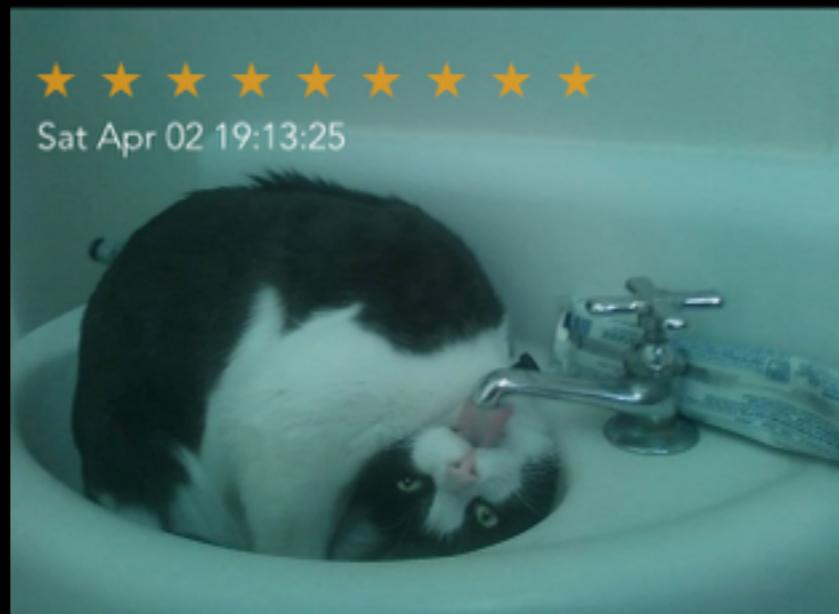
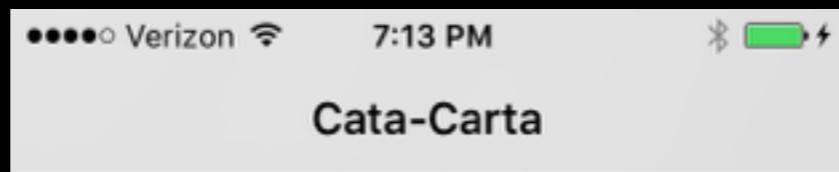




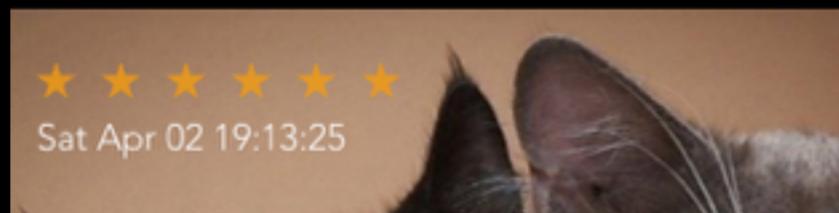
Cata-Carta



Cata-Carta

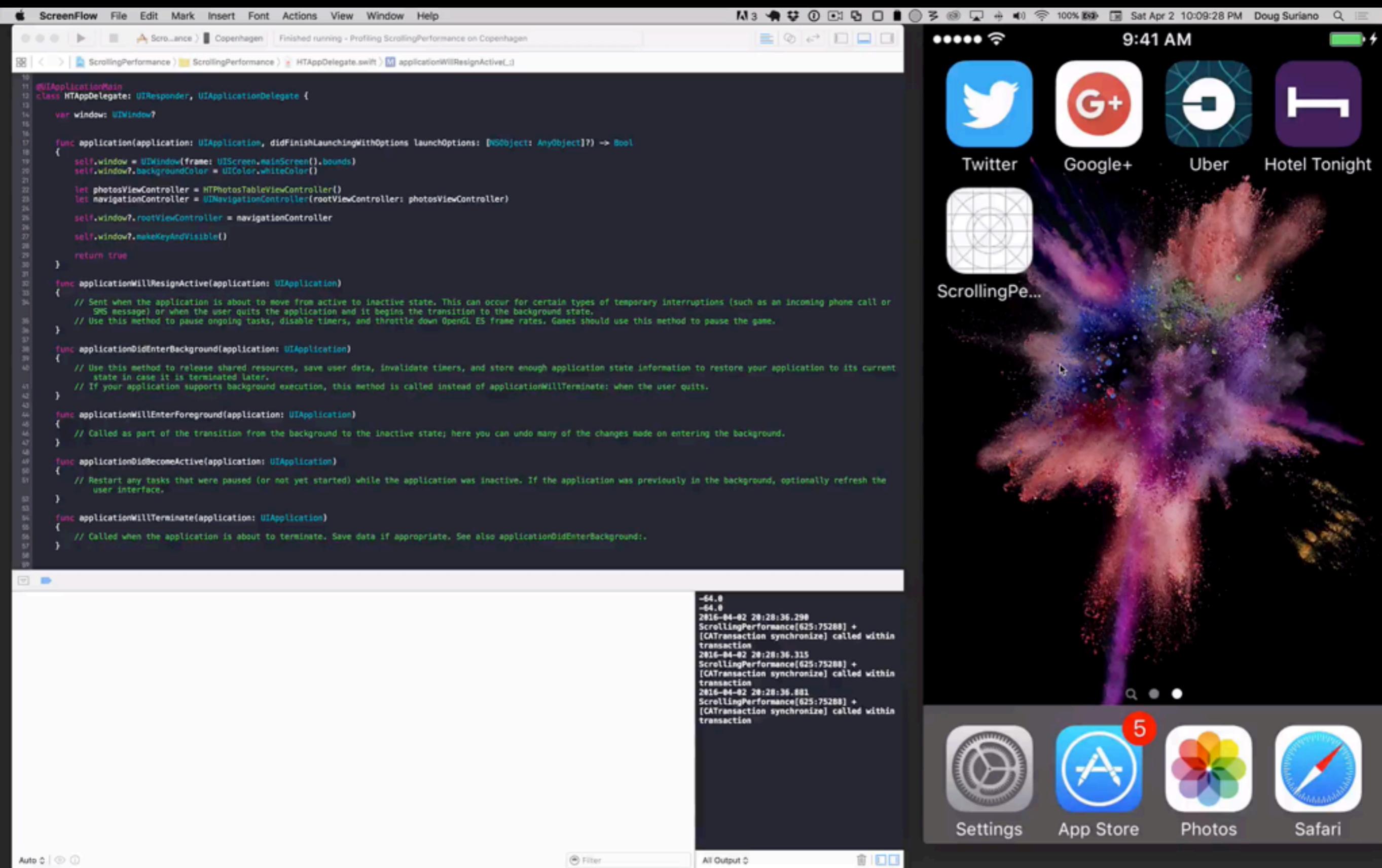


[25] There is to be a single **measure for wine** throughout our realm, and a single measure for ale, and a single **measure for Corn**, that is to say the London quarter, and a single breadth for dyed cloth, russets, and **haberjects**, that is to say two yards within the lists. And it shall be the same for weights as for measures.



Cata-Carta

- Swift App
- Single UITableViewController
- Images are part of the bundle (stored in assets)
- Magna Carta quotes are read from a JSON file (also in the bundle).
- Intentionally the worst code I've ever written.



Ouch.

Unusable.

What do we do?

- Start commenting out random lines?
- Breakpoints? NSLog ?
- git reset –hard ?
- Tweet how much you hate Xcode?

What do we do?

- ~~Start commenting out random lines?~~
- Breakpoints? NSLog ?
- git reset –hard ?
- Tweet how much you hate Xcode?

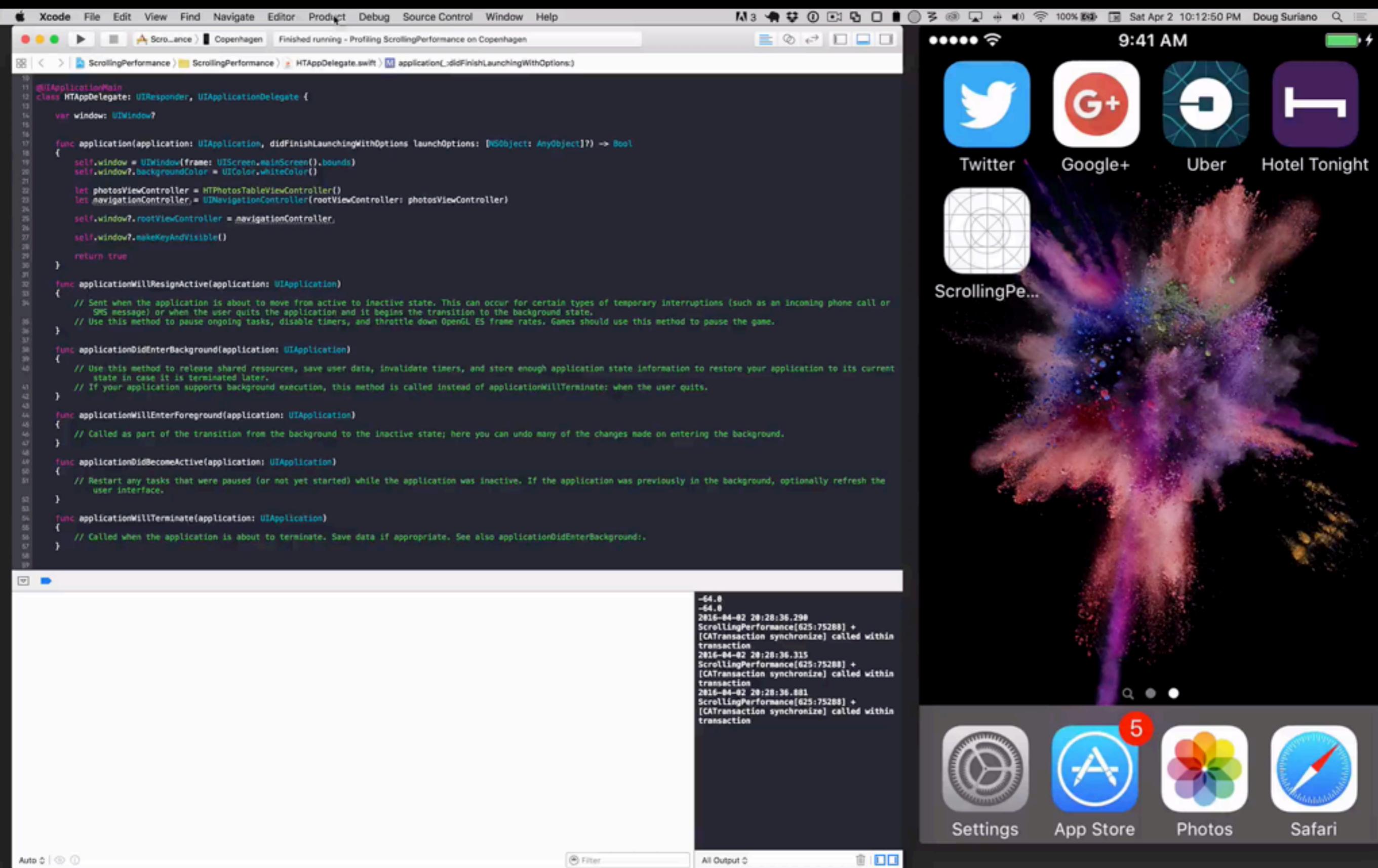
What do we do?

- ~~Start commenting out random lines?~~
- ~~Breakpoints? NSLog?~~
- git reset –hard ?
- Tweet how much you hate Xcode?

What do we do?

- ~~Start commenting out random lines?~~
- ~~Breakpoints? NSLog?~~
- ~~git reset --hard?~~
- Tweet how much you hate Xcode?

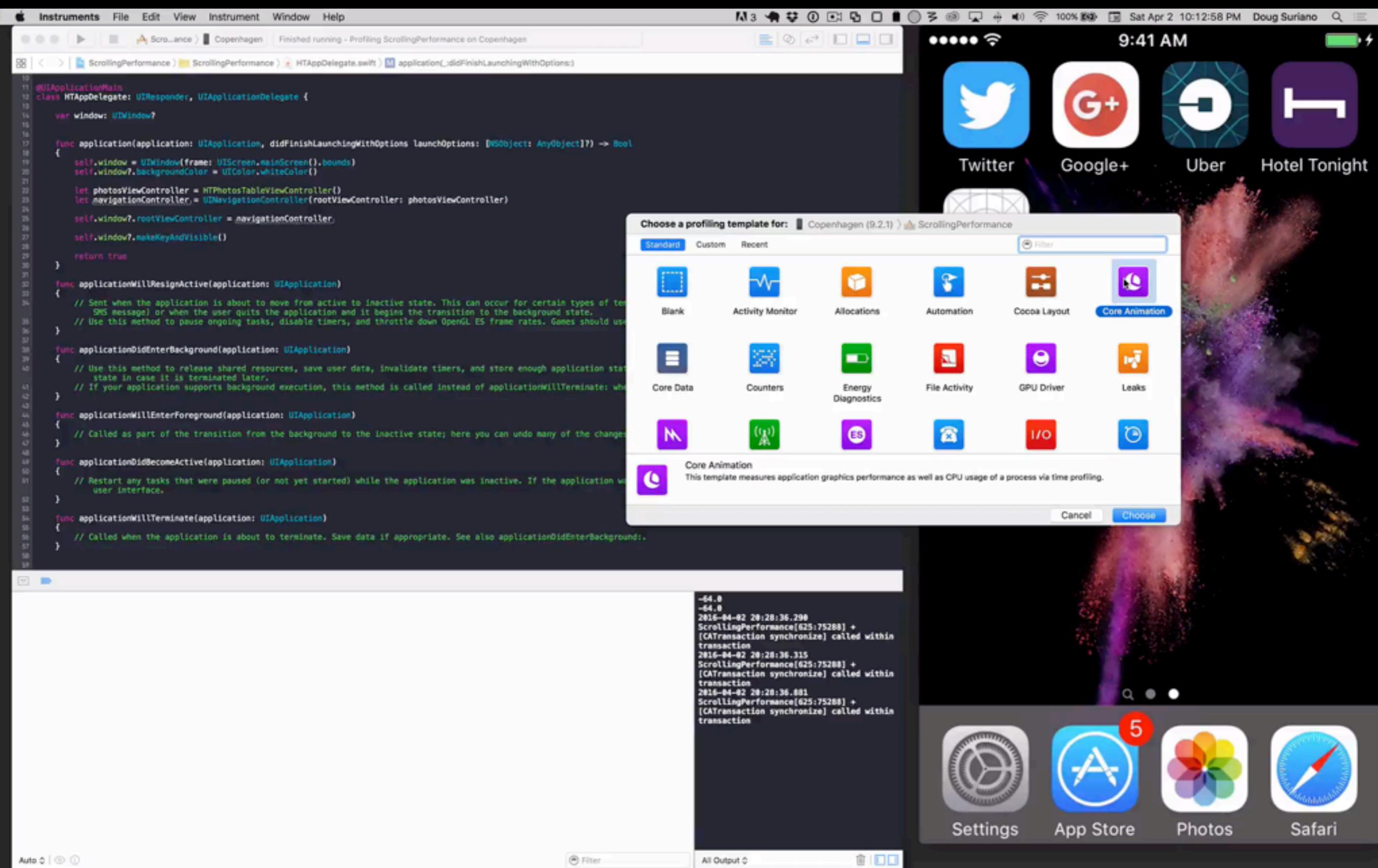


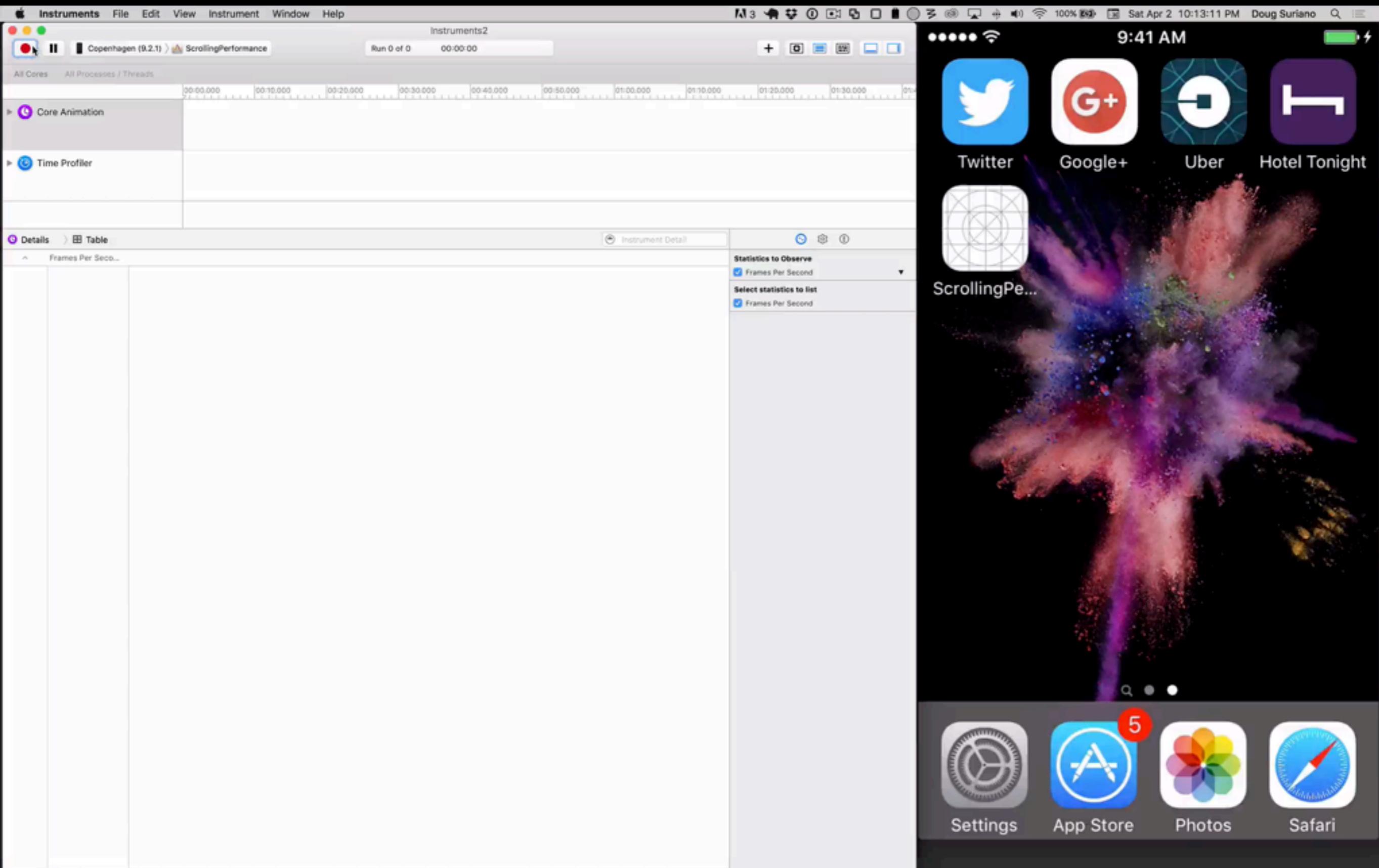


The screenshot displays the Xcode IDE on a Mac. The main window shows the code for the `HTAppDelegate` class, which is a subclass of `UIResponder` and `UIApplicationDelegate`. The code handles various application lifecycle methods:

- `application(application: UIApplication, didFinishLaunchingWithOptions: [NSObject: AnyObject]?) -> Bool`
- `applicationWillResignActive(application: UIApplication)`
- `applicationDidEnterBackground(application: UIApplication)`
- `applicationWillEnterForeground(application: UIApplication)`
- `applicationDidBecomeActive(application: UIApplication)`
- `applicationWillTerminate(application: UIApplication)`

The Xcode interface includes a toolbar with icons for Run, Stop, and Build. A file browser on the left shows the project structure. At the bottom, there's a navigation bar with icons for Settings, App Store, Photos, and Safari. A red notification badge with the number '5' is visible on the App Store icon. The status bar at the top right shows the date as Sat Apr 2 10:12:52 PM, the time as 9:41 AM, and battery level at 100%.





Instruments2

Copenhagen (9.2.1) > ScrollingPerformance

Run 1 of 1

00:00:19

+

All Cores All Processes / Threads

0 00:00.000 00:10.000 00:20.000 00:30.000 00:40.000 00:50.000 01:00.000 01:10.000 01:20.000

Frames Per Second



CPU Usage



Details Table

Instrument Detail

Frames Per Seco...

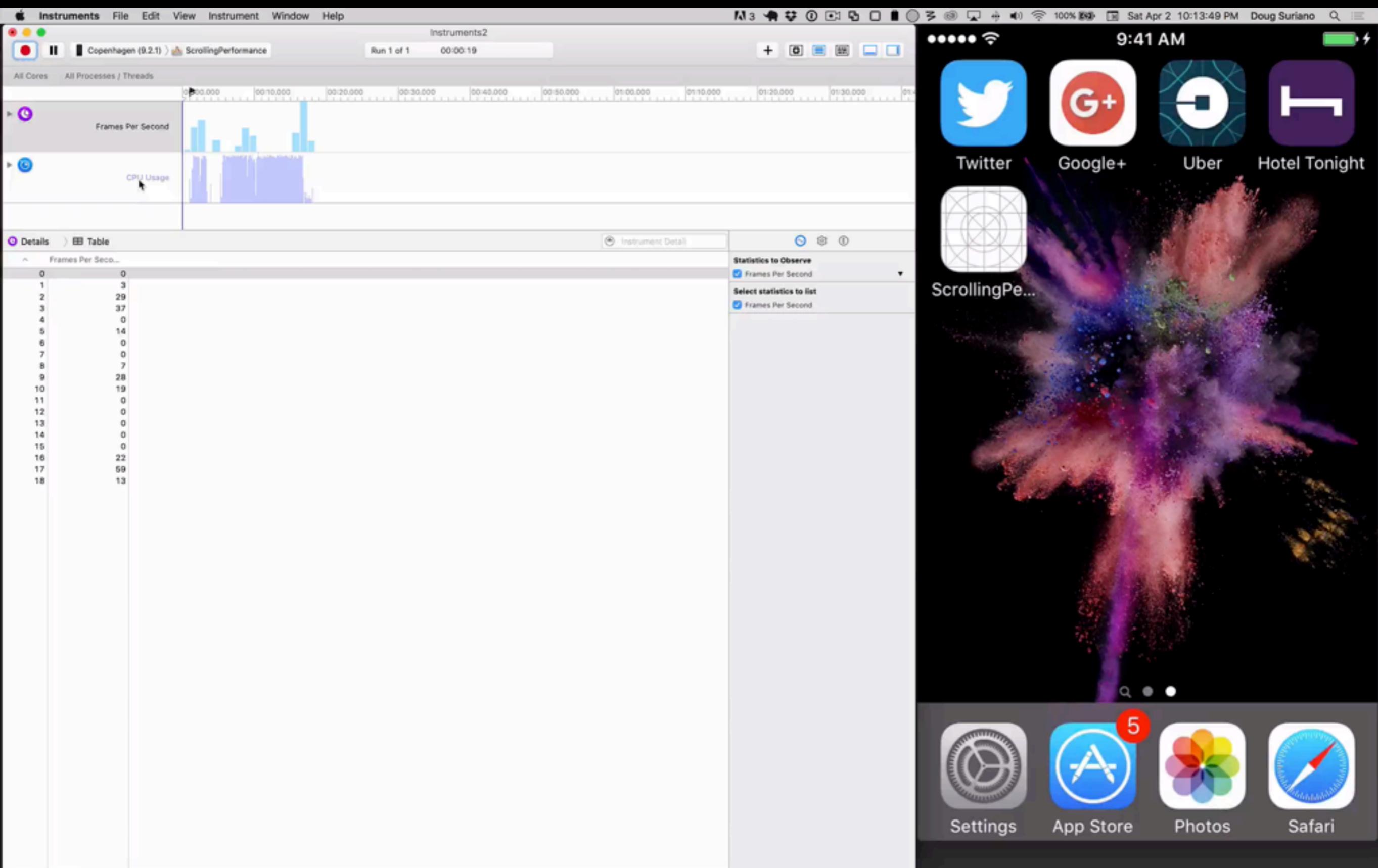
0	0
1	3
2	29
3	37
4	0
5	14
6	0
7	0
8	7
9	28
10	19
11	0
12	0
13	0
14	0
15	0
16	22
17	59
18	13

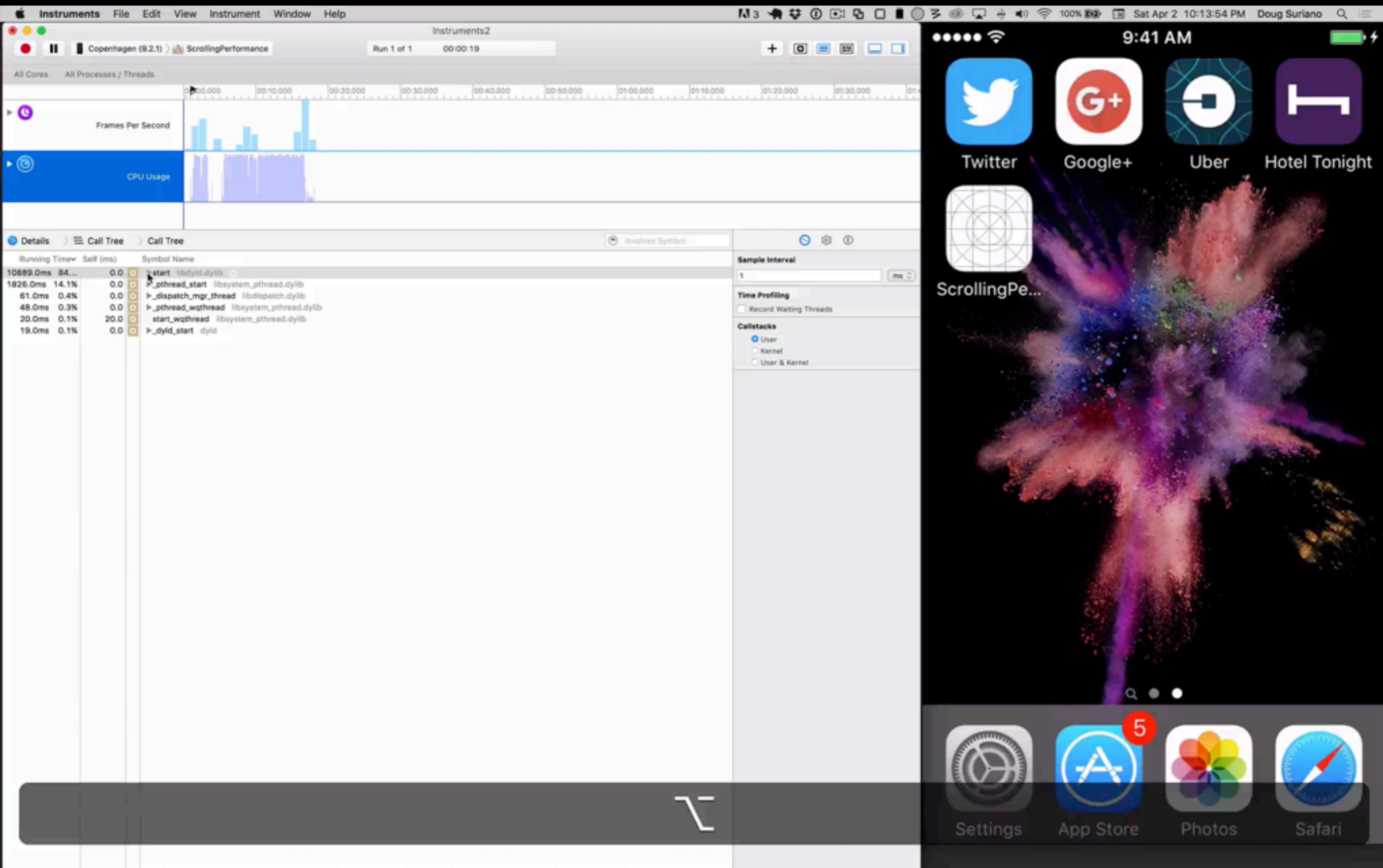
Statistics 1

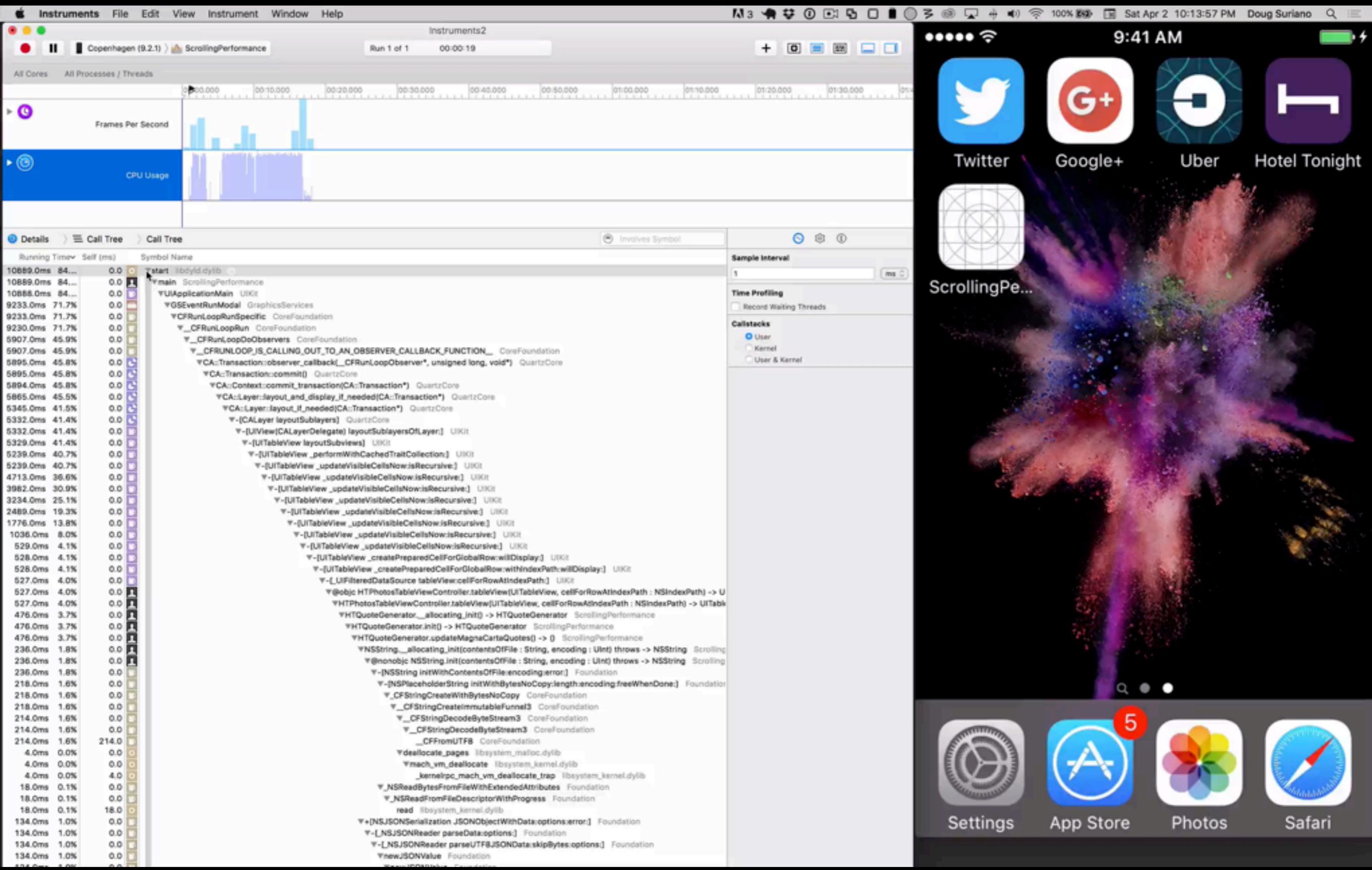
 Frames

Select stat

 Frames







```
N_ CoreFoundation  
g, void*) QuartzCore  
  
Core  
  
it  
Kit   
UIKit  
UIKit  
:] UIKit  
ve:] UIKit  
sive:] UIKit  
rsive:] UIKit  
IRow:willDisplay:] UIKit  
realRow:withIndexPath:willDisplay:] UIKit  
orRowAtIndexPath:] UIKit  
bleView(UITableView, cellForRowAtIndexPath : NSIndexPath) -> U  
ew(UITableView, cellForRowAtIndexPath : NSIndexPath) -> UITableView  
) -> HTQuoteGenerator ScrollingPerformance  
oteGenerator ScrollingPerformance  
aCartaQuotes() -> () ScrollingPerformance  
entsOfFile : String, encoding : UInt) throws -> NSString Scrolling  
entsOfFile : String, encoding : UInt) throws -> NSString Scrolling
```

⌚ Involves Symbol

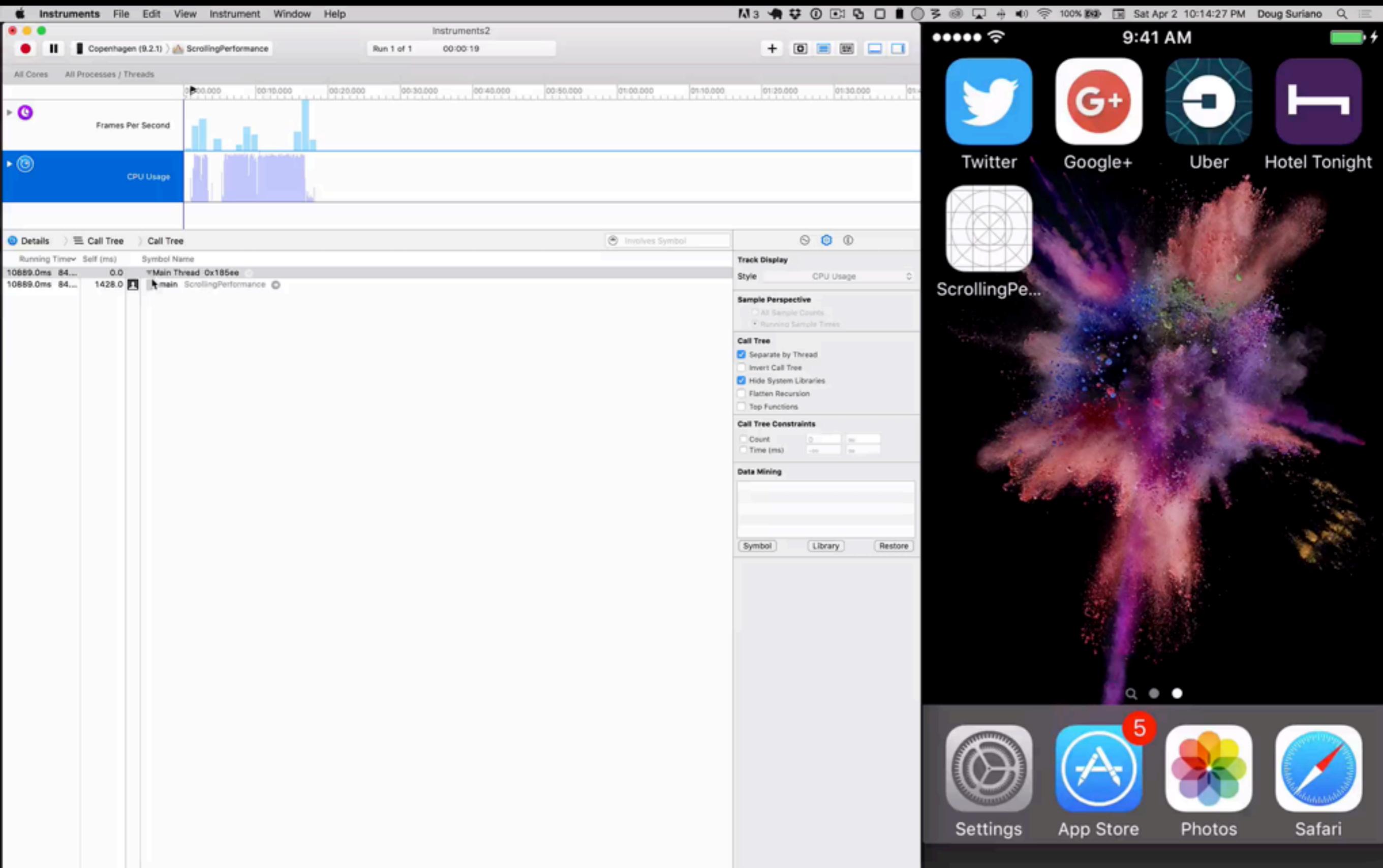
⌚ ⓘ ⚡

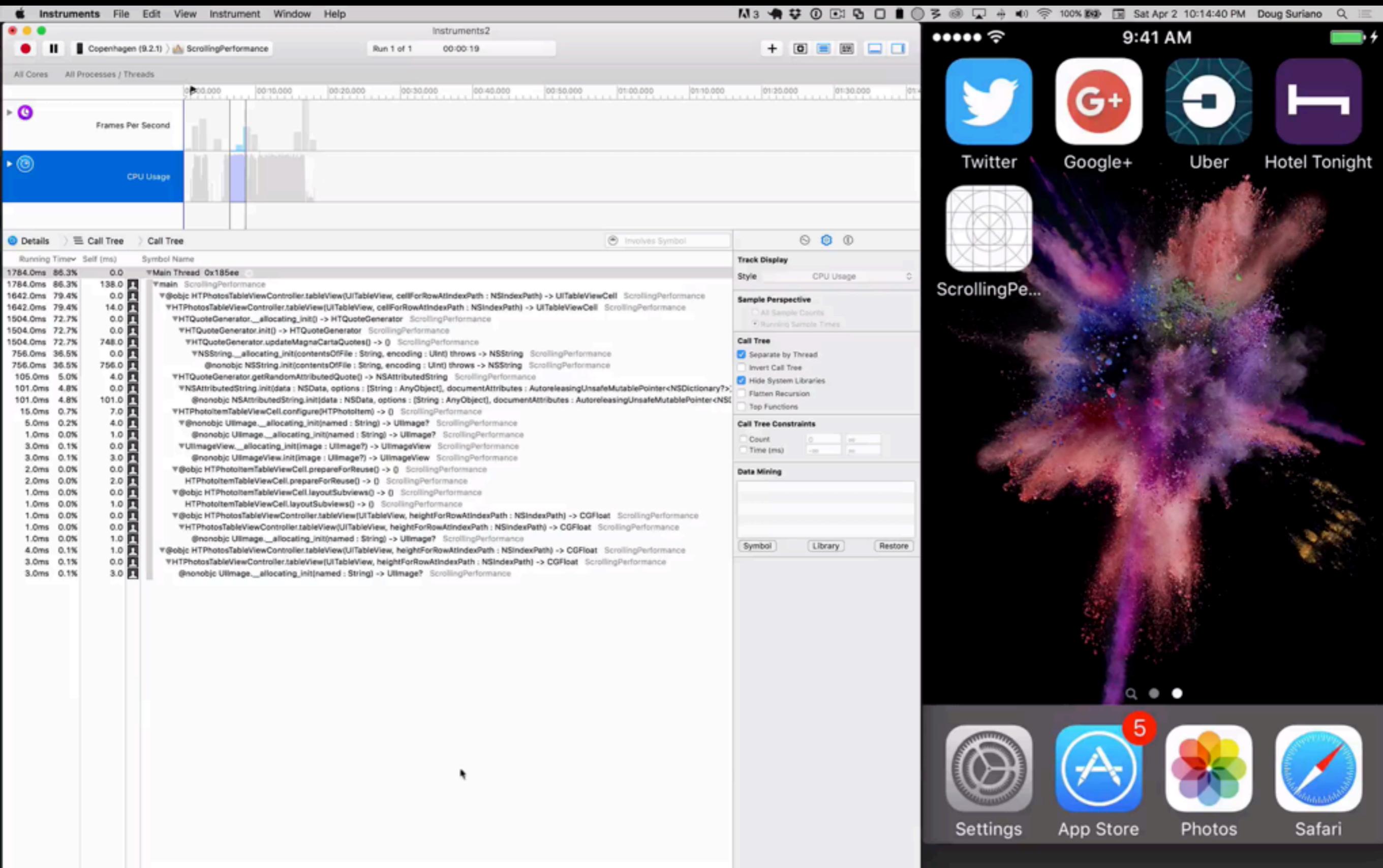
Sample Interval
1 ms

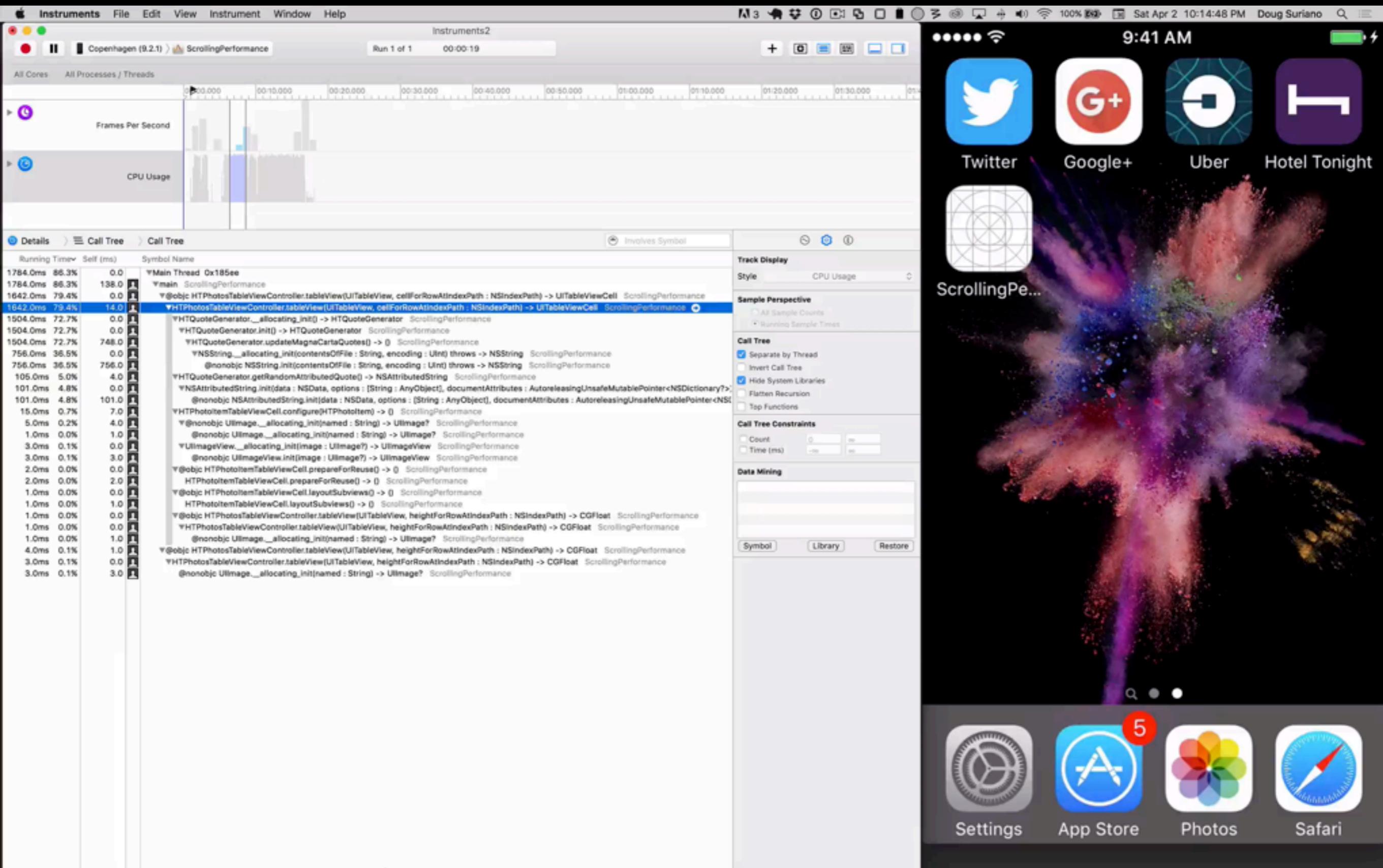
Time Profiling
 Record Waiting Threads

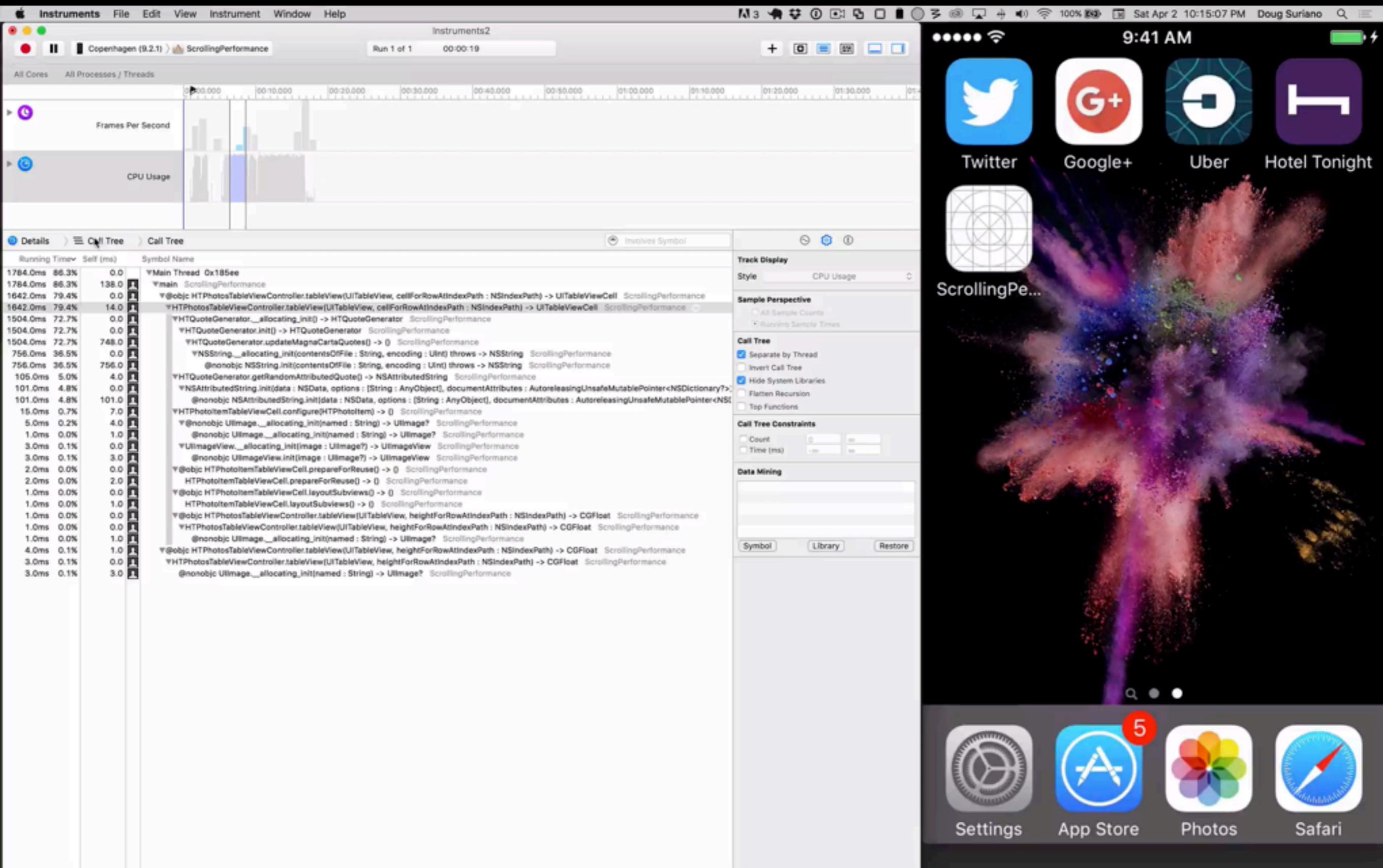
Callstacks
 User
 Kernel
 User & Kernel











Mistakes were made.

Mistakes were made

- Too much work on the main thread.
- Not reusing objects.
- No caching.

But now we know our
problem areas.

Performance Fix #1

- Create HTQuoteGenerator once, instead of each time.
- Move my heavy lifting (File I/O, JSON parsing, attributed string creation) off the main thread.

We didn't have to
guess.

Xcode File Edit View Find Navigate Editor Product Debug Source Control Window Help

Scrol...ance Copenhagen Finished running ScrollingPerformance on Copenhagen

9:41 AM

Scrol...ance

Scrol...ance

magna.json

HTAppDelegate.swift

HTPhotoItem.swift

HTPhotosTableViewController.swift

HTViewController.swift

Assets.xcassets

LaunchScreen.storyboard

Info.plist

HTPhotoItemTableViewCell.swift

HTPhotoItemGenerator.swift

HTQuoteGenerator.swift

Products

ScrollingPerformance

HTPhotoItemTableViewCell.swift

```
29
30    self.quoteContainerView = UIView()
31    self.quoteContainerView.backgroundColor = UIColor.blackColor()
32
33    for _ in 0...10
34    {
35        let imageView = UIImageView(image: UIImage(named: "star"))
36        imageView.hidden = true
37        self.starViews.append(imageView)
38    }
39
40    super.init(style: style, reuseIdentifier: reuseIdentifier)
41
42    self.contentView.addSubview(self.quoteContainerView)
43    self.contentView.addSubview(self.photoView)
44    self.contentView.addSubview(self.quoteLabel)
45    self.contentView.addSubview(self.dateLabel)
46
47    for imageView in self.starViews
48    {
49        self.contentView.addSubview(imageView)
50    }
51
52    required init?(coder aDecoder: NSCoder)
53    {
54        fatalError("init(coder:) has not been implemented")
55    }
56
57    override func layoutSubviews()
58    {
59        super.layoutSubviews()
60
61        self.photoView.frame = CGRect(x: 0.0, y: 0.0, width: self.bounds.size.width, height: self.bounds.size.height - 150.0)
62
63        self.quoteContainerView.frame = CGRect(x: 0.0, y: self.photoView.frame.size.height, width: self.bounds.size.width, height: 150.0)
64
65        self.quoteLabel.frame = self.quoteContainerView.frame
66
67        var xOffset: CGFloat = 10.0
68
69        for starView in self.starViews
70        {
71            starView.frame = CGRectMake(xOffset, 20.0, 15.0, 15.0)
72            xOffset = xOffset + 25.0
73        }
74
75        self.dateLabel.frame = CGRect(x: 10.0, y: 40.0, width: self.bounds.width, height: 14.0)
76    }
77
78    override func prepareForReuse()
79    {
80        super.prepareForReuse()
81
82        for starView in self.starViews
83        {
84            starView.hidden = true
85        }
86
87        self.quoteLabel.alpha = 0.0
88        self.photoView.alpha = 1.0
89    }
90
91    func configure(photoItem: HTPhotoItem)
92    {
93        dispatch_async(dispatch_get_global_queue(DISPATCH_QUEUE_PRIORITY_HIGH, 0), {
94            let image = UIImage(named: photoItem.photoName)
95            dispatch_sync(dispatch_get_main_queue(), { () -> Void in
96                self.photoView.image = image
97                self.photoView.alpha = 1.0
98            })
99        })
100
101        for i in 0...photoItem.numberOfStars
102        {
103            self.starViews[i].hidden = false
104        }
105
106        self.dateLabel.text = "Sun Apr 03 08:14:09"
107
108        self.setNeedsLayout()
109    }
110
111 }
```

Twitter Google+ Uber Hotel Tonight

ScrollingPe...

Q ● ●

5

Settings App Store Photos Safari

...a quick interlude.

#1

```
npm install makeAppScrollGood
```

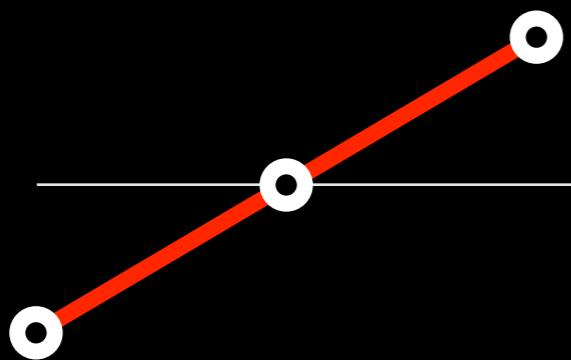
Instruments simply gives
you data in an easily
consumable way.

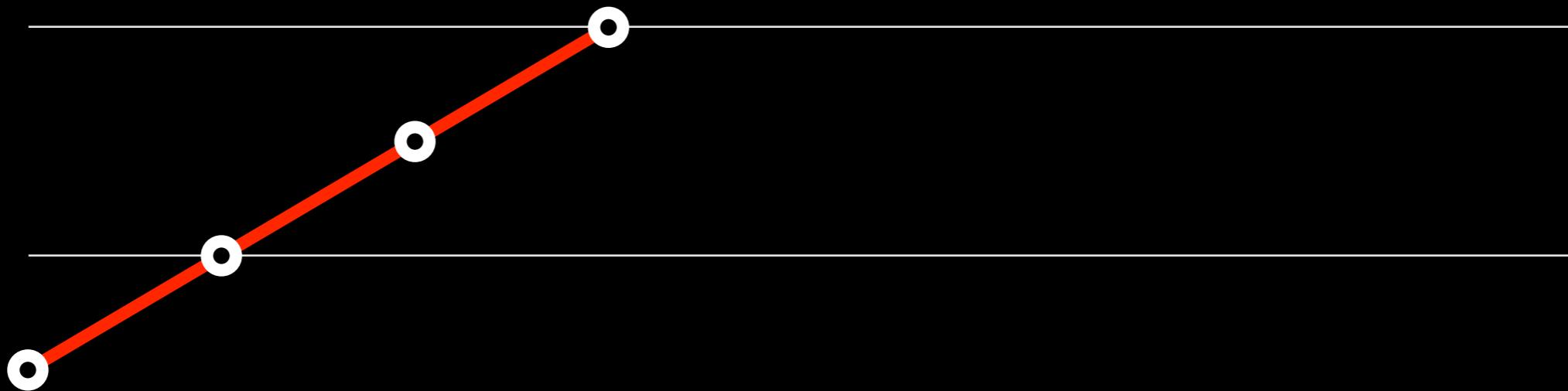
Profile. Modify. Test.

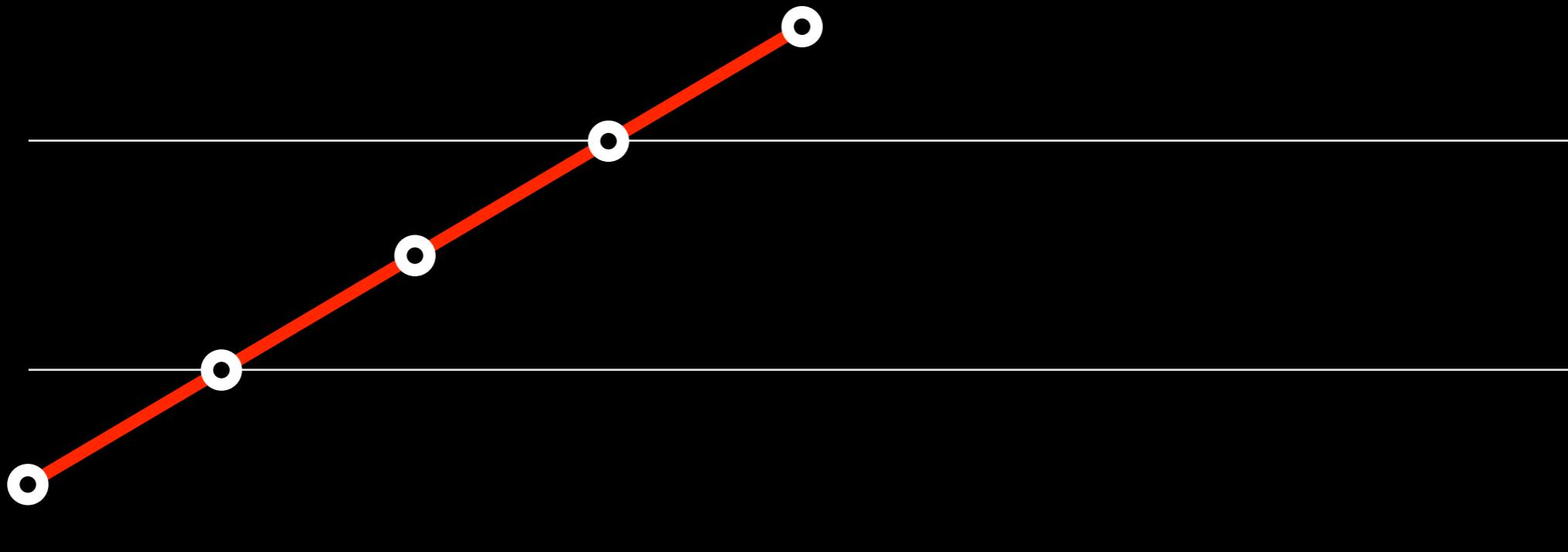


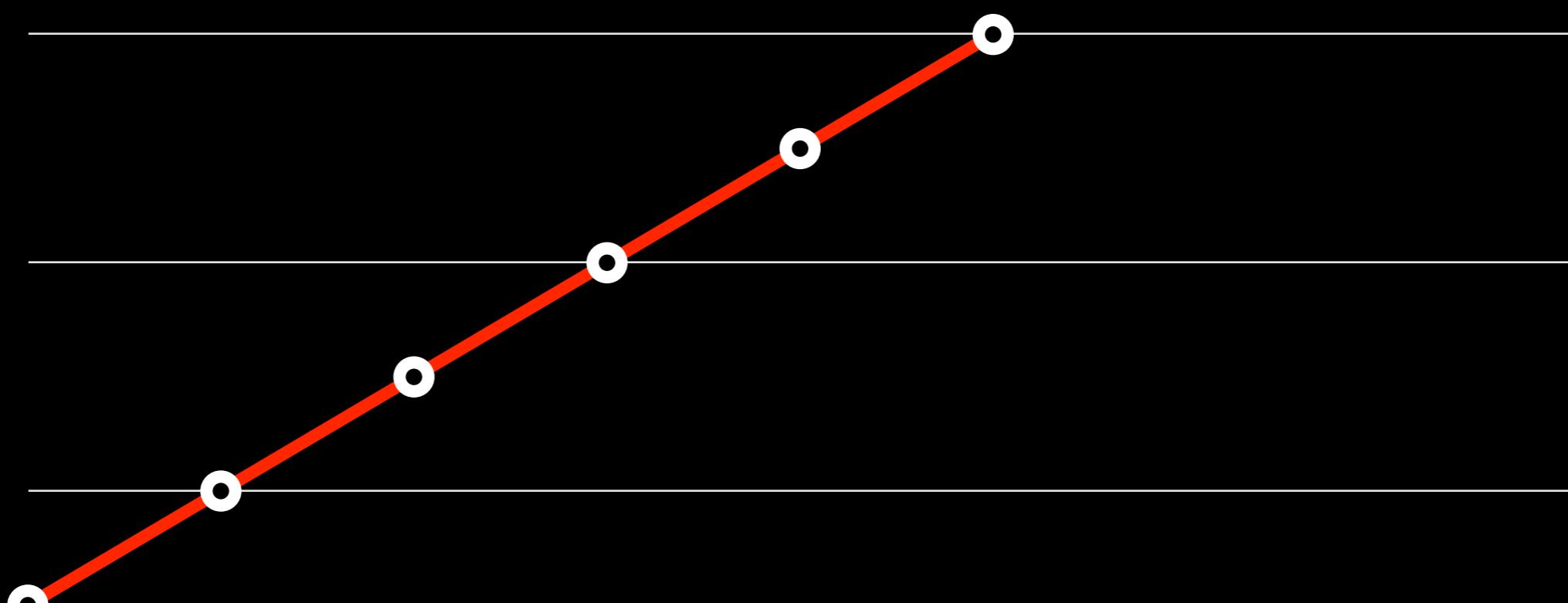
Memory

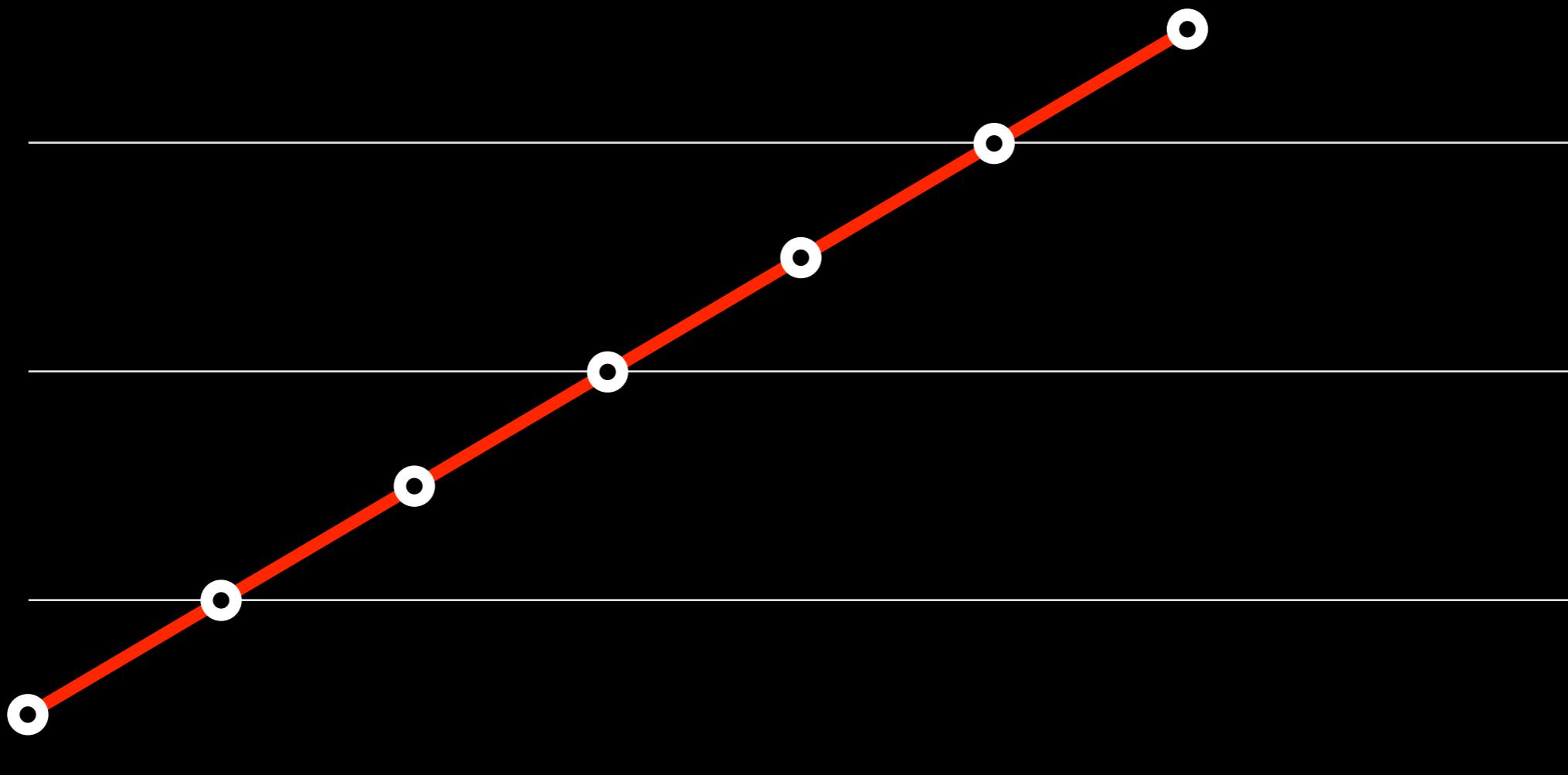
The Silent Killers.

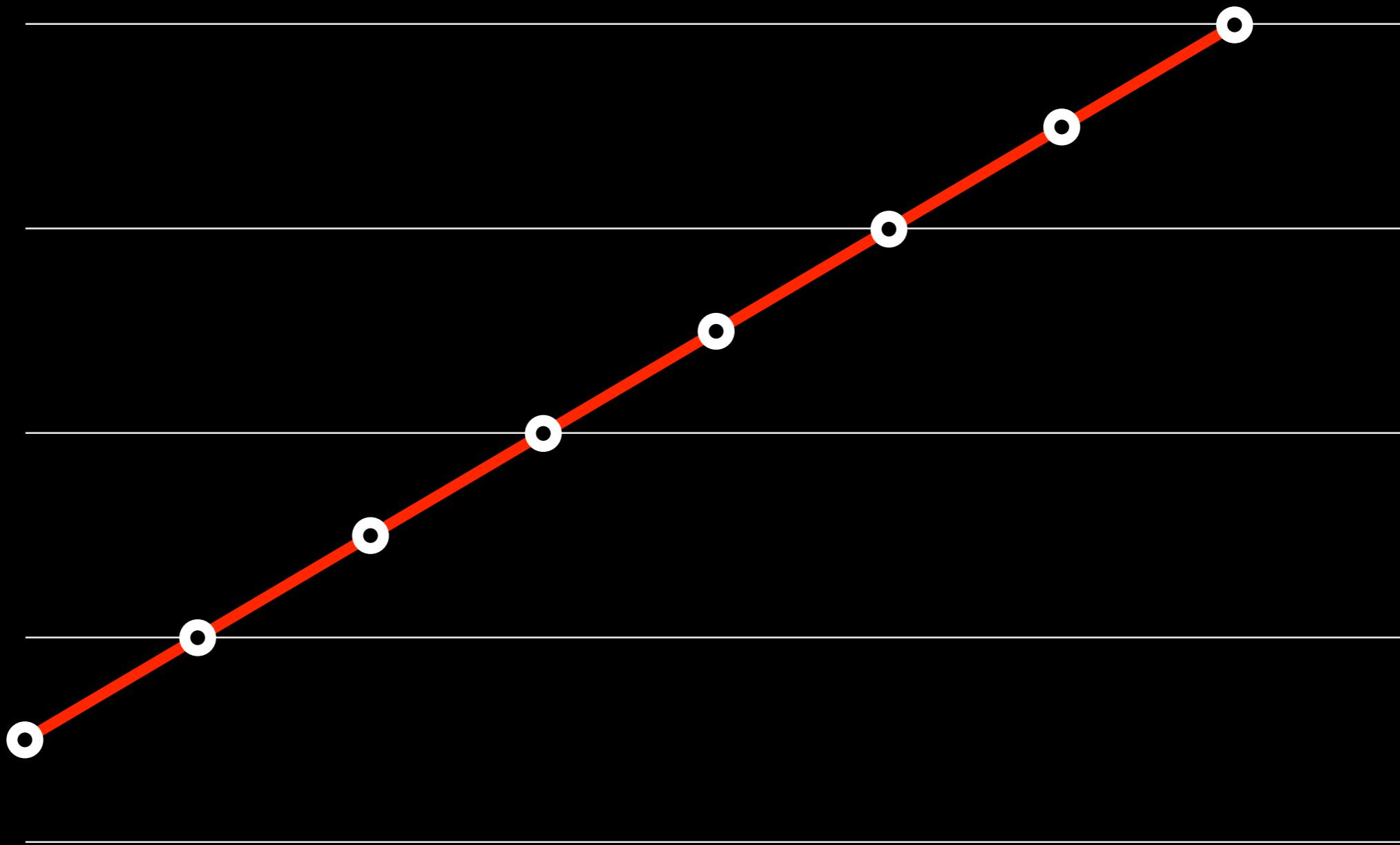


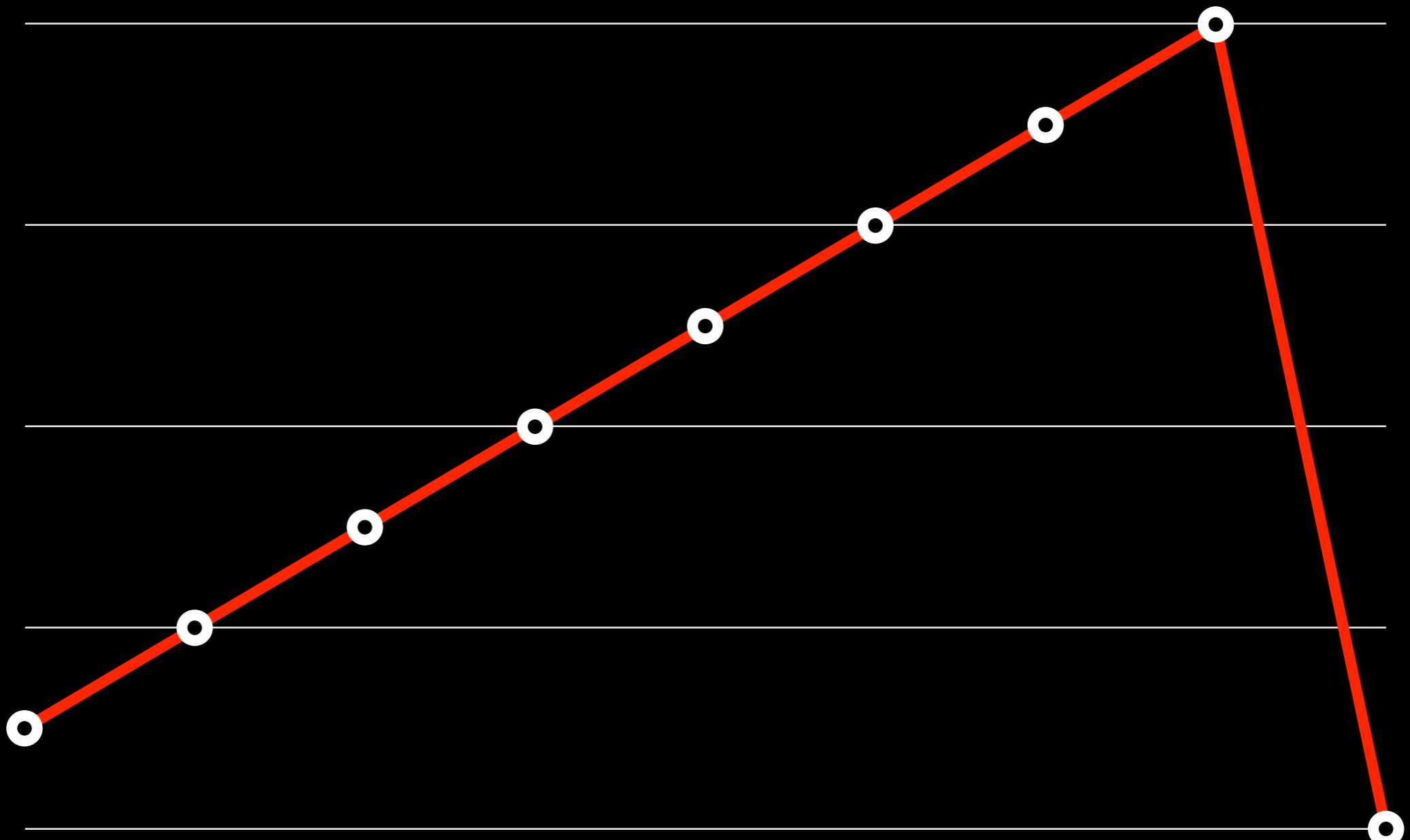












memory_problems != fun

ScreenFlow File Edit Mark Insert Font Actions View Window Help

Mem...blems Copenhagen Finished running - Profiling MemoryProblems on Copenhagen

```
1 // AppDelegate.m
2 // MemoryProblems
3 //
4 // Created by Doug Suriano on 4/3/16.
5 // Copyright © 2016 Hotel Tonight. All rights reserved.
6 //
7 //
8
9 #import "MEMAppDelegate.h"
10 #import "MEMMenuViewController.h"
11
12 @interface MEMAppDelegate ()
```

@end

```
13
14 @implementation MEMAppDelegate
```

15

```
16
17
18 - (BOOL)application:(UIApplication *)application didFinishLaunchingWithOptions:(NSDictionary *)launchOptions
19 {
20     self.window = [[UIWindow alloc] initWithFrame:[UIScreen mainScreen].bounds];
21     self.window.backgroundColor = [UIColor whiteColor];
22
23     MEMMenuViewController *vc = [[MEMMenuViewController alloc] initWithNibName:nil bundle:nil];
24     UINavigationController *navController = [[UINavigationController alloc] initWithRootViewController:vc];
25
26     self.window.rootViewController = navController;
27
28     [self.window makeKeyAndVisible];
29
30     return YES;
31 }
32
33 @end
```

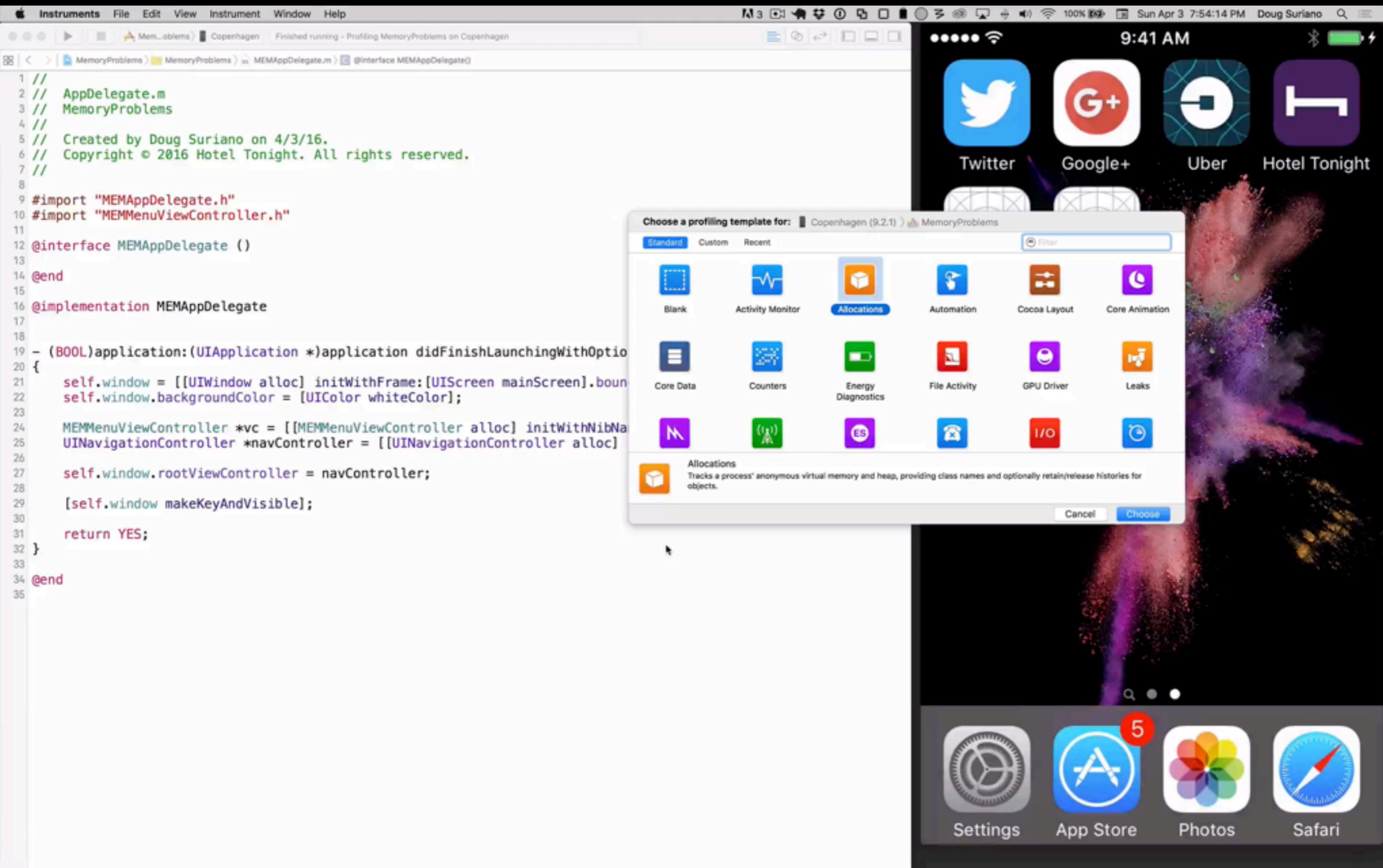
9:41 AM

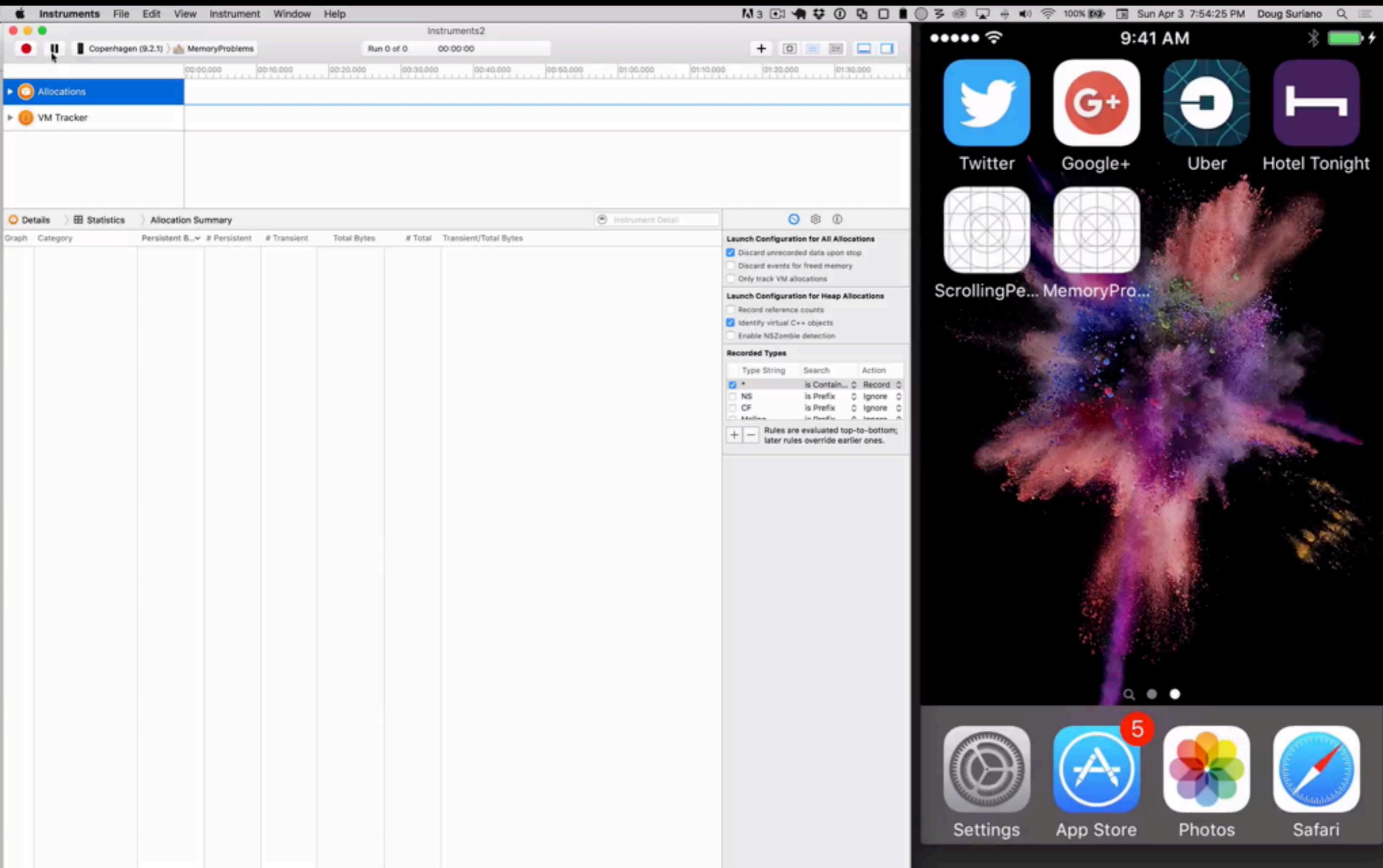
Twitter Google+ Uber Hotel Tonight

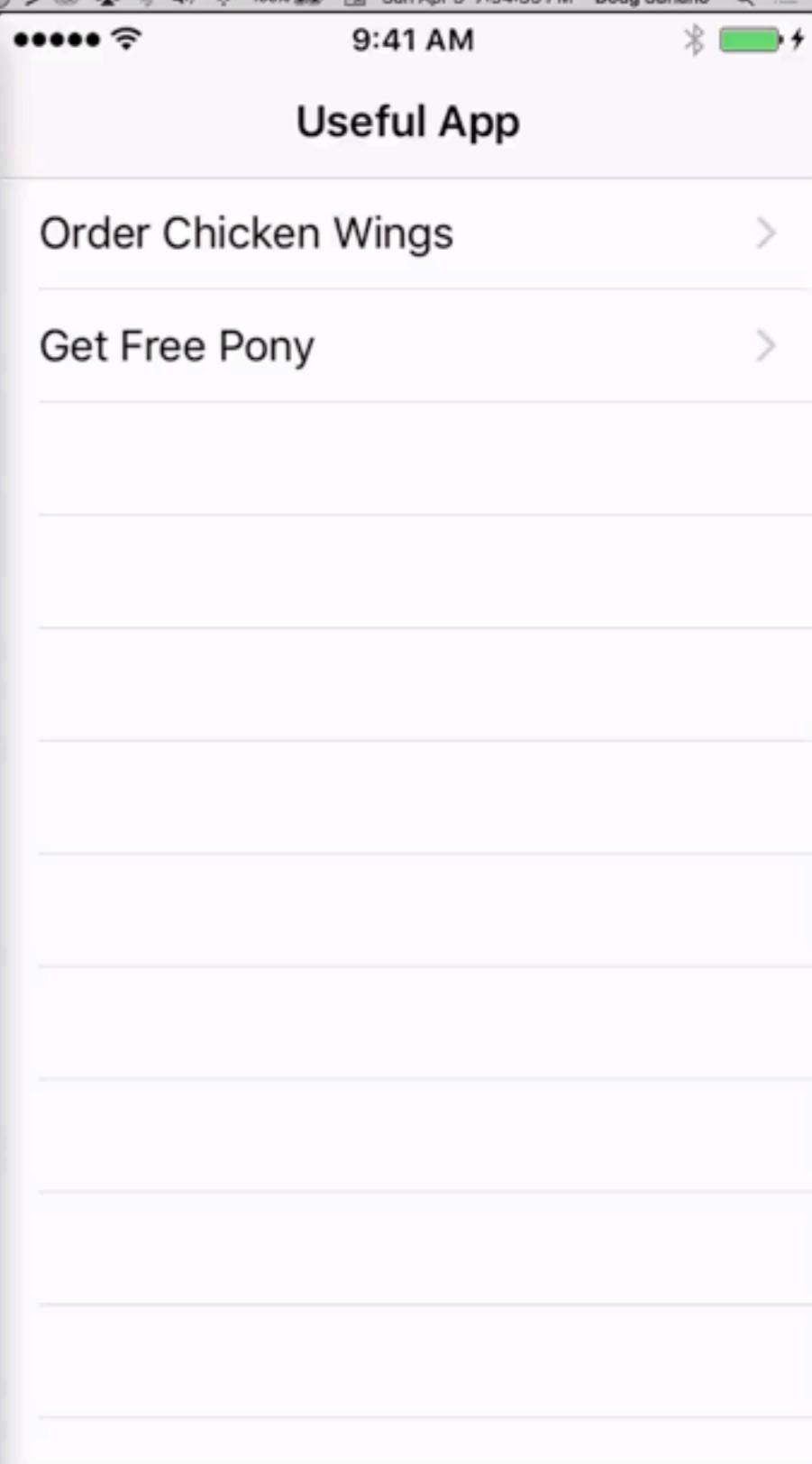
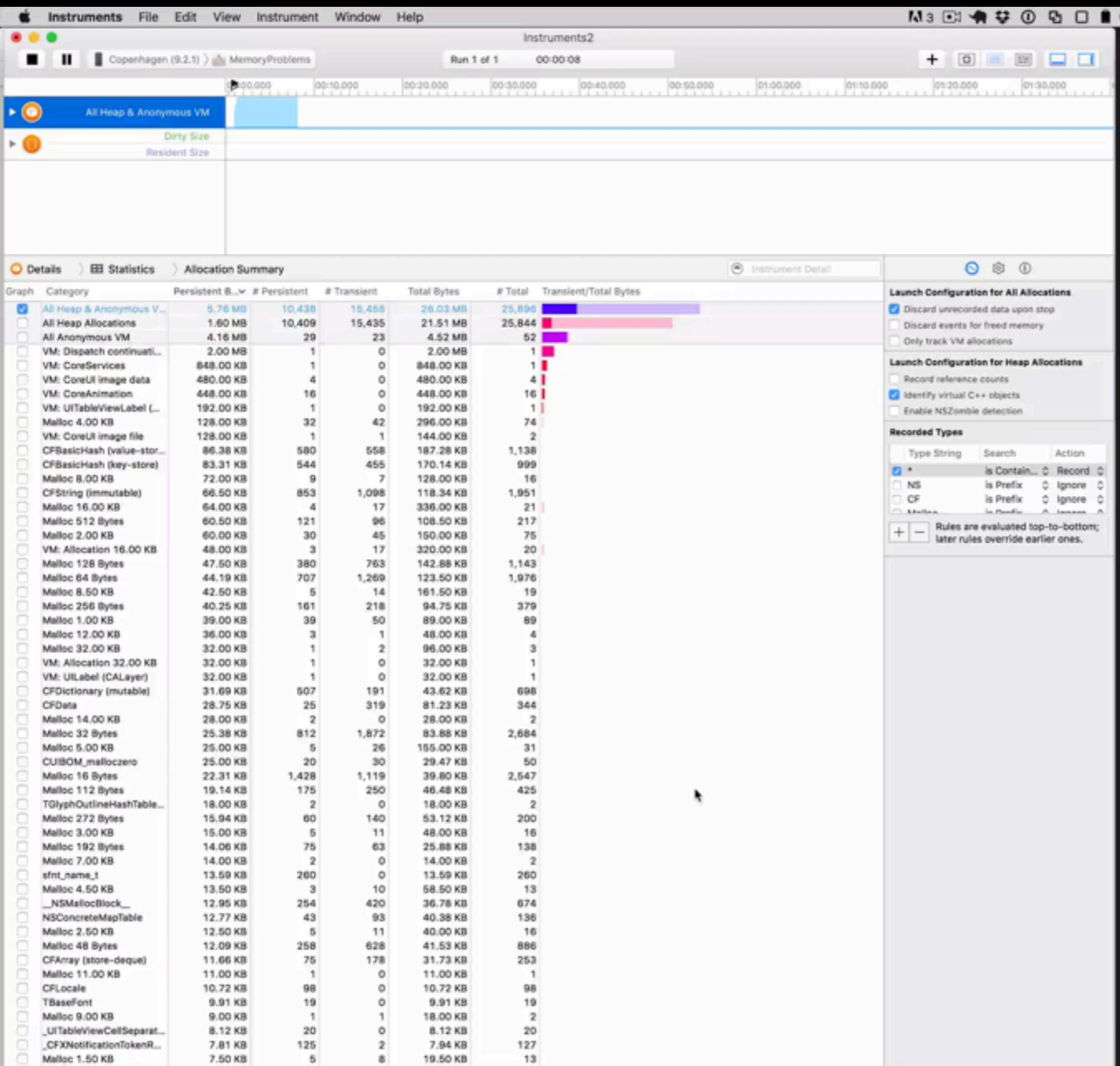
ScrollingPe... MemoryPro...

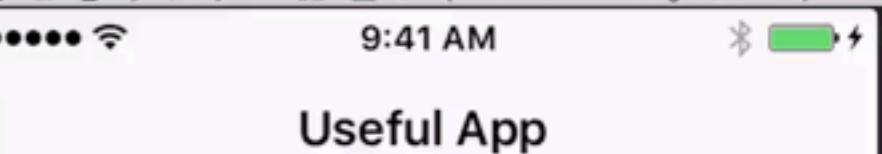
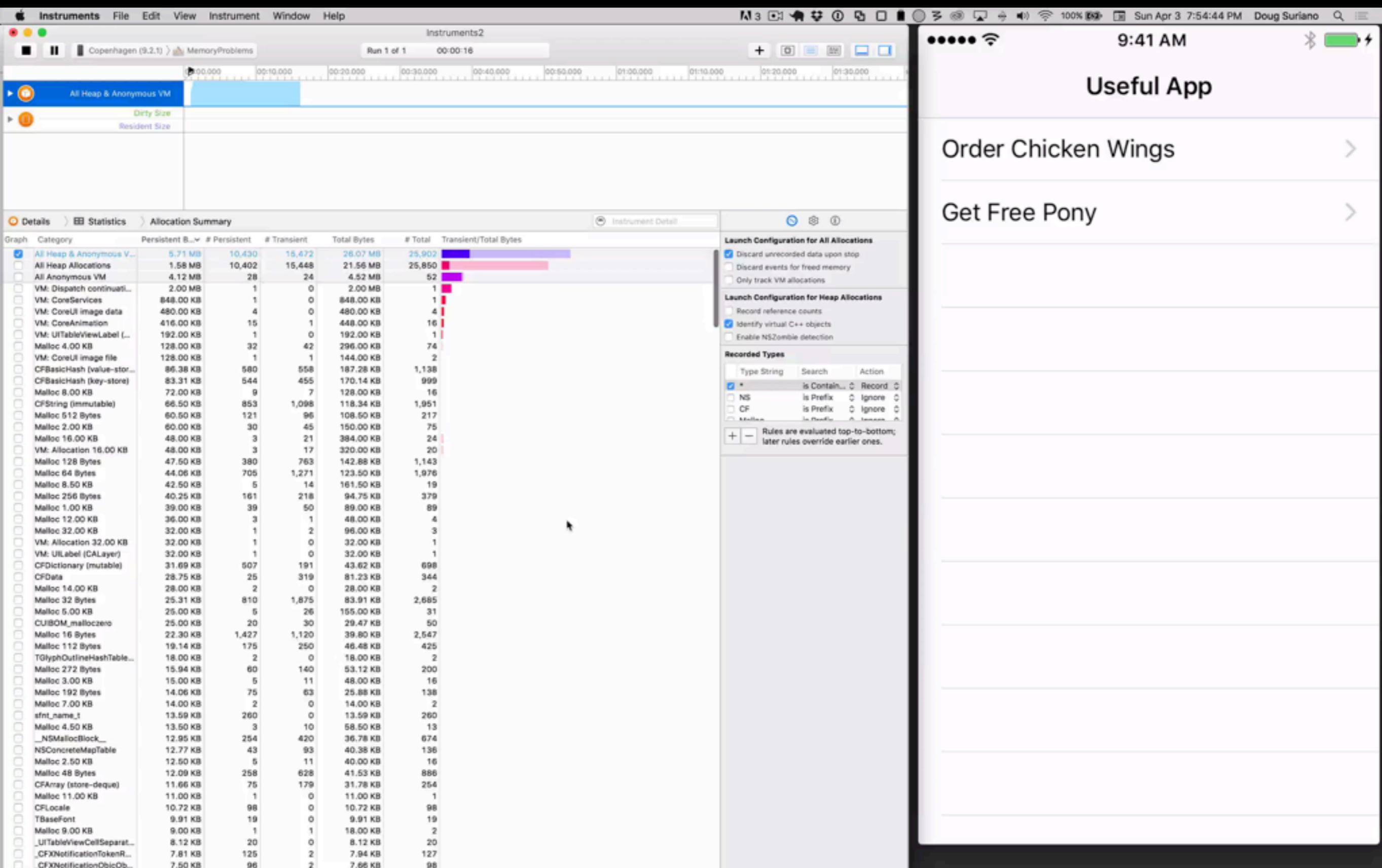
Settings App Store Photos Safari

The image shows a Mac desktop with two windows open. On the left is a terminal window titled 'ScreenFlow' showing the code for 'AppDelegate.m'. The code is a simple implementation of the UIApplicationDelegate protocol, creating a window and pushing a 'MEMMenuViewController' onto it. On the right is a screenshot of an iPhone displaying its home screen. The home screen has a colorful, abstract background. At the top, there are four app icons: Twitter, Google+, Uber, and Hotel Tonight. Below them are two more app icons with a grid pattern. At the bottom of the screen, there's a dock with four more app icons: Settings, App Store, Photos, and Safari. The App Store icon has a red notification badge with the number '5'.









Instrument Detail

Launch Configuration for All Allocations

Discard unrecorded data upon stop
 Discard events for freed memory
 Only track VM allocations

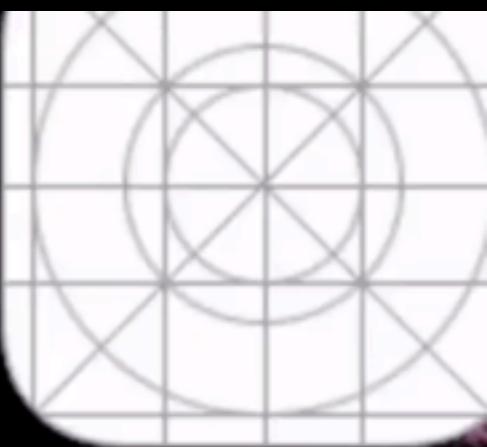
Launch Configuration for Heap Allocations

Record reference counts
 Identify virtual C++ objects
 Enable NSZombie detection

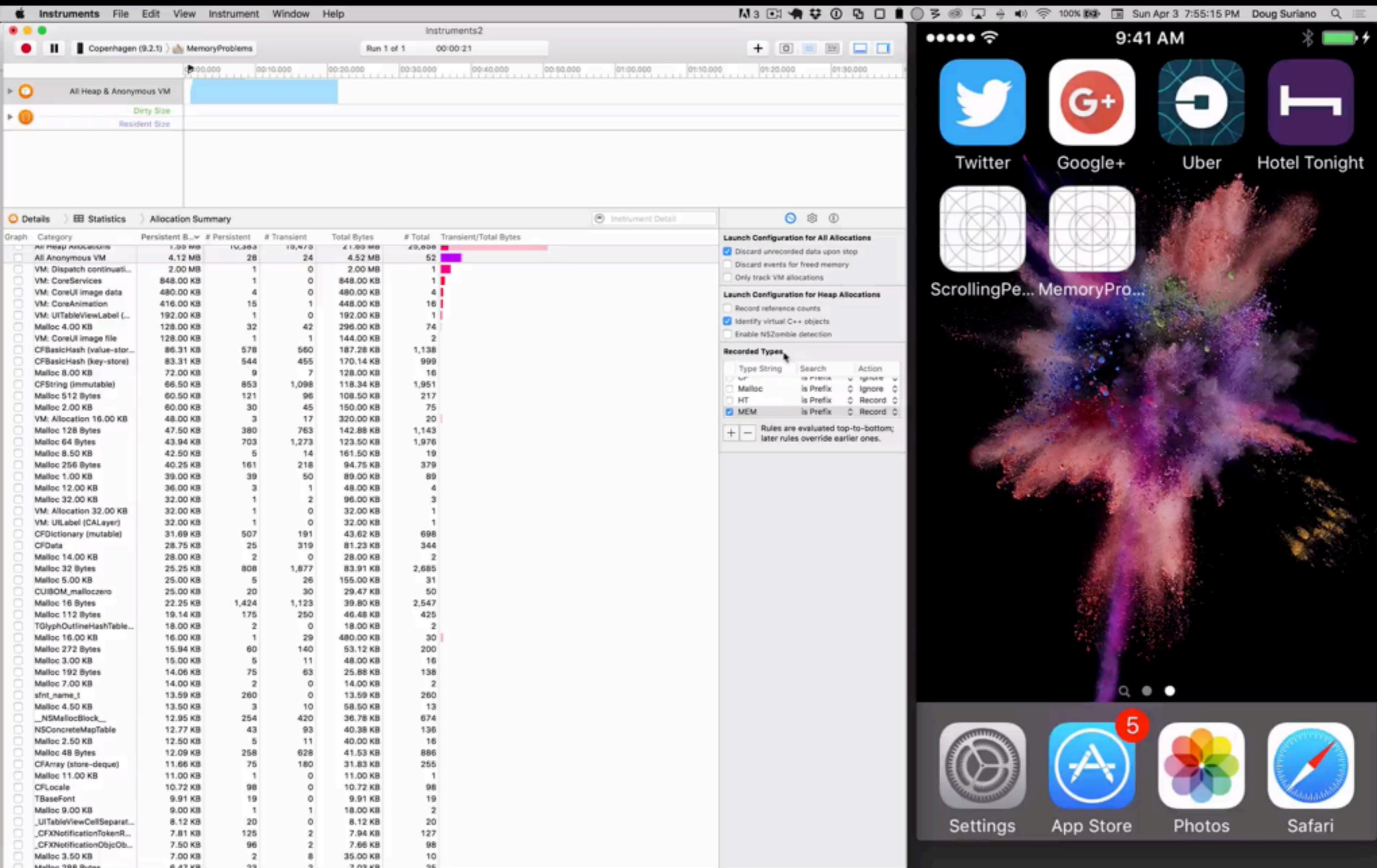
Recorded Types

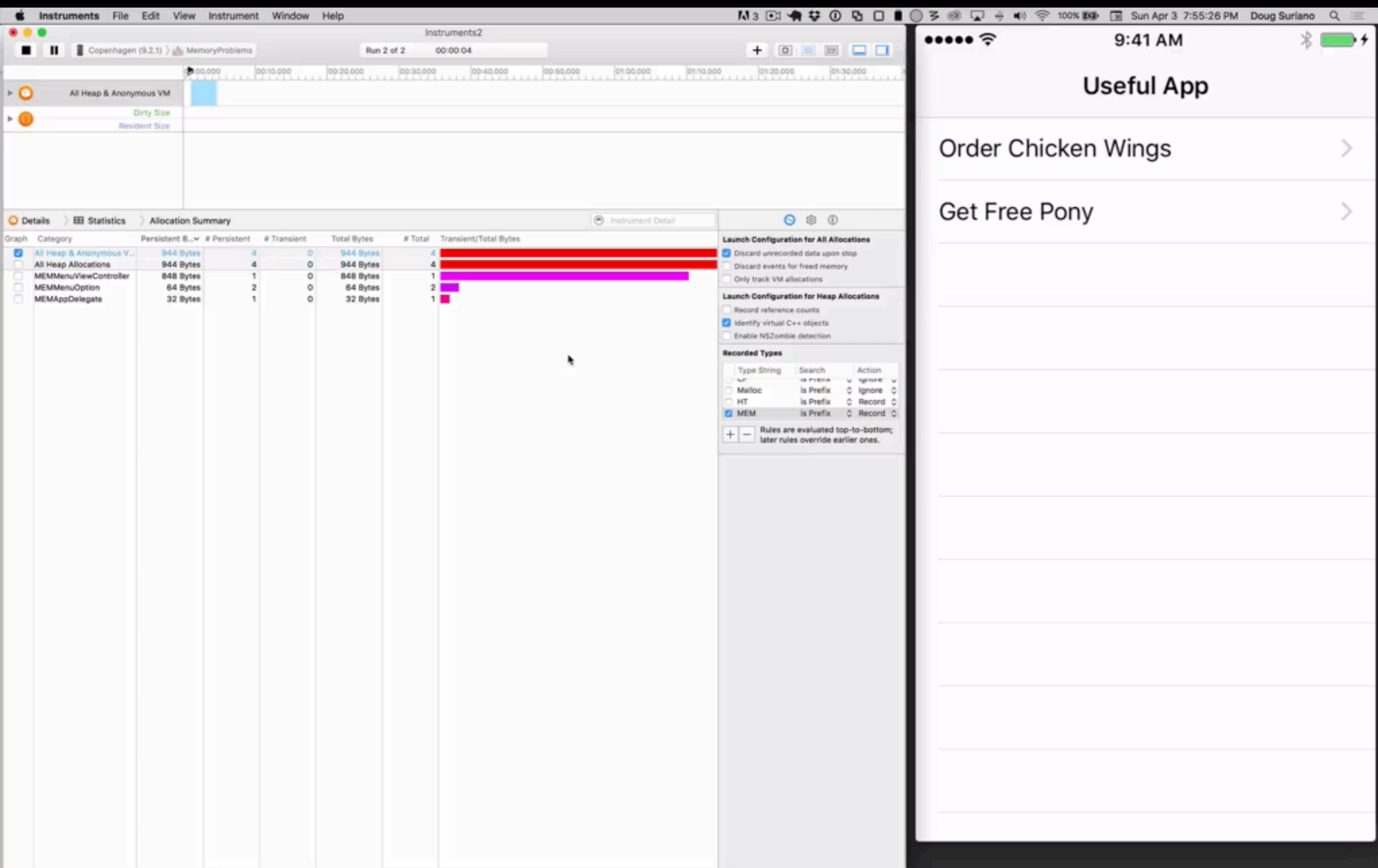
Type String	Search	Action
<input checked="" type="checkbox"/> *	is Contain...	Record
<input type="checkbox"/> NS	is Prefix	Ignore
<input type="checkbox"/> CF	is Prefix	Ignore
<input type="checkbox"/> Malloc	is Prefix	Ignore

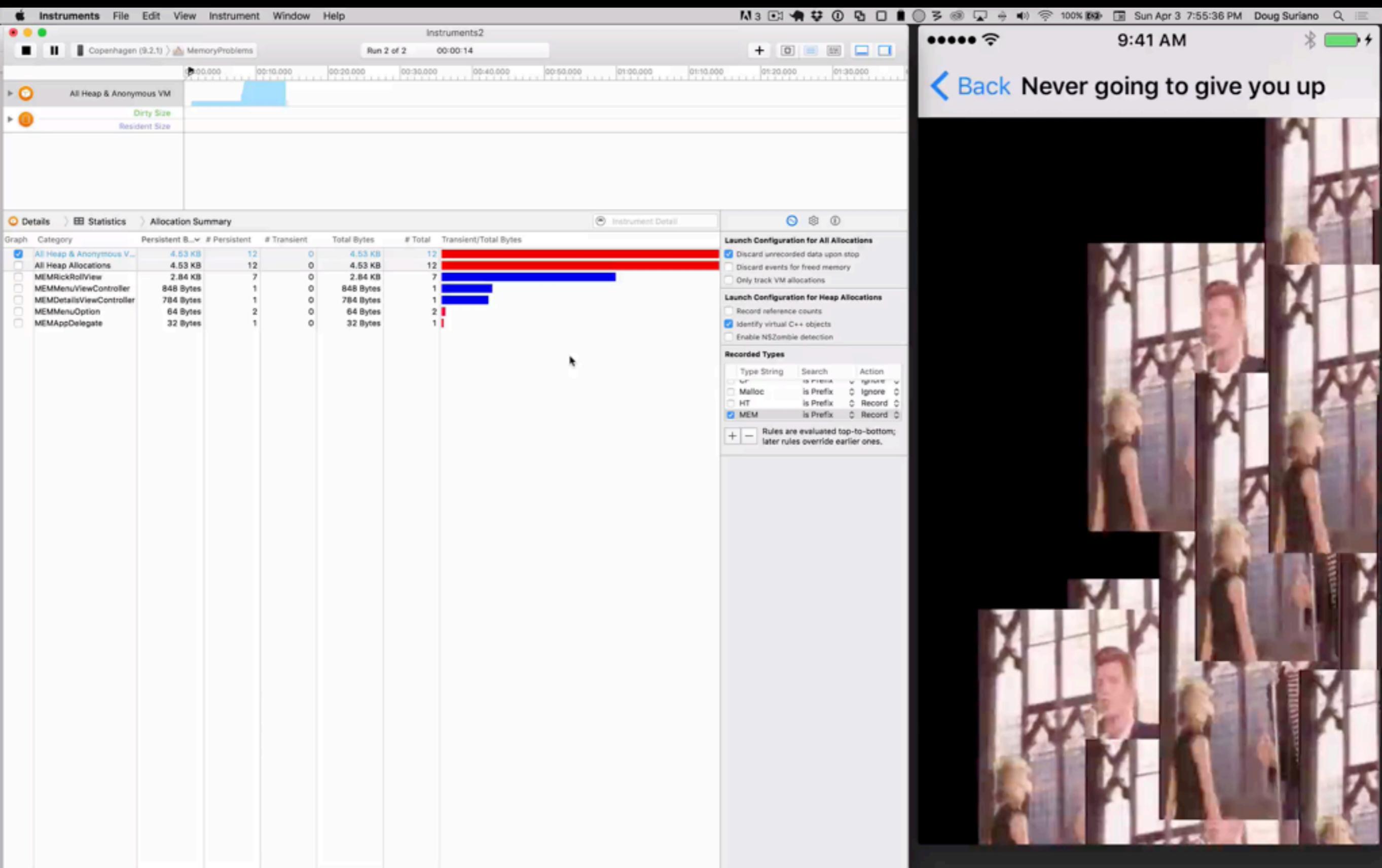
+ - Rules are evaluated top-to-bottom;
later rules override earlier ones.



ScrollingPe



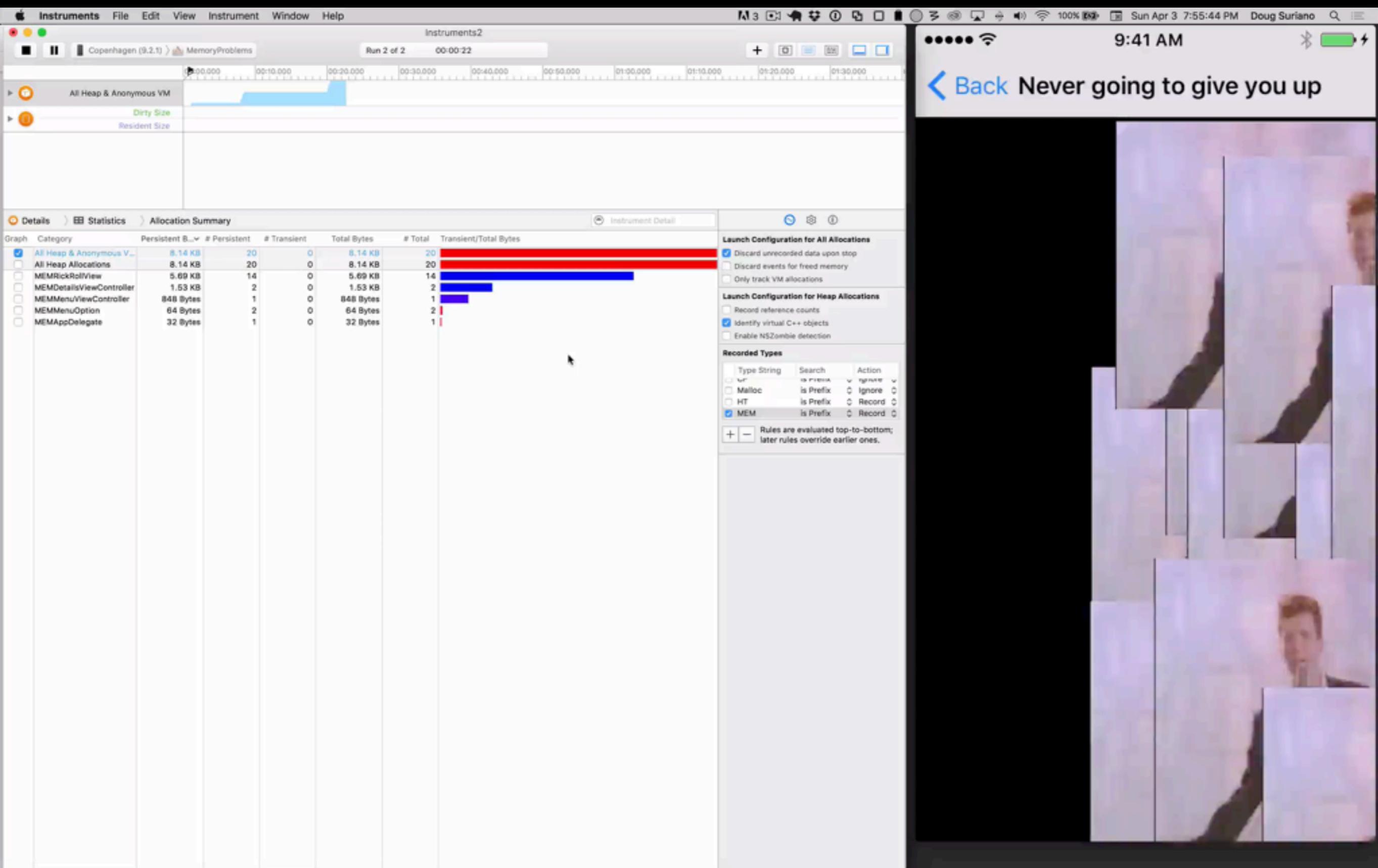






Details > Statistics > Allocation Summary

Graph	Category	Persistent B...	# Persistent	# Transient	Total Bytes	# Total	Transient/Total Bytes
<input checked="" type="checkbox"/>	All Heap & Anonymous V...	4.53 KB	12	0	4.53 KB	12	<div style="width: 100%; background-color: red;"></div>
<input type="checkbox"/>	All Heap Allocations	4.53 KB	12	0	4.53 KB	12	<div style="width: 100%; background-color: red;"></div>
<input type="checkbox"/>	MEMRickRollView	2.84 KB	7	0	2.84 KB	7	<div style="width: 100%; background-color: blue;"></div>
<input type="checkbox"/>	MEMMenuViewController	848 Bytes	1	0	848 Bytes	1	<div style="width: 100%; background-color: blue;"></div>
<input type="checkbox"/>	MEMDetailsViewController	784 Bytes	1	0	784 Bytes	1	<div style="width: 100%; background-color: blue;"></div>
<input type="checkbox"/>	MEMMenuOption	64 Bytes	2	0	64 Bytes	2	<div style="width: 100%; background-color: red;"></div>
<input type="checkbox"/>	MEMAppDelegate	32 Bytes	1	0	32 Bytes	1	<div style="width: 100%; background-color: red;"></div>





Instruments

File Edit

View

Instrument

Windows

Help

1 / 3

Instruments2

1

11

1

Copenhagen (9.2.1) >

 MemoryProblems

Run 2 of 2

00:00:43

0:00.000

00:10.000

00:20.000

00:30.000

00:40.000

loc

All Heap & Anonymous VM



Dirty Size

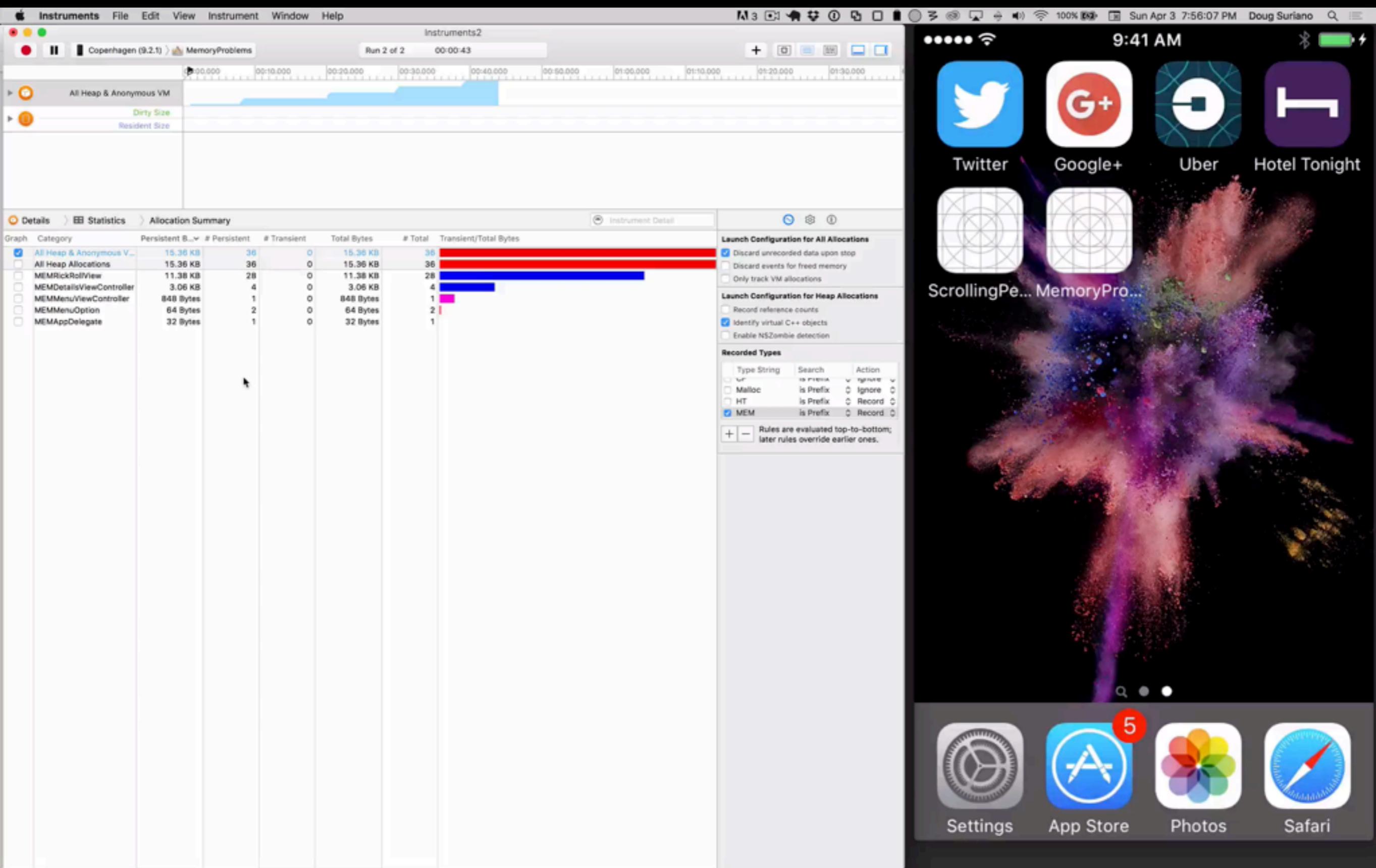
Resident Size

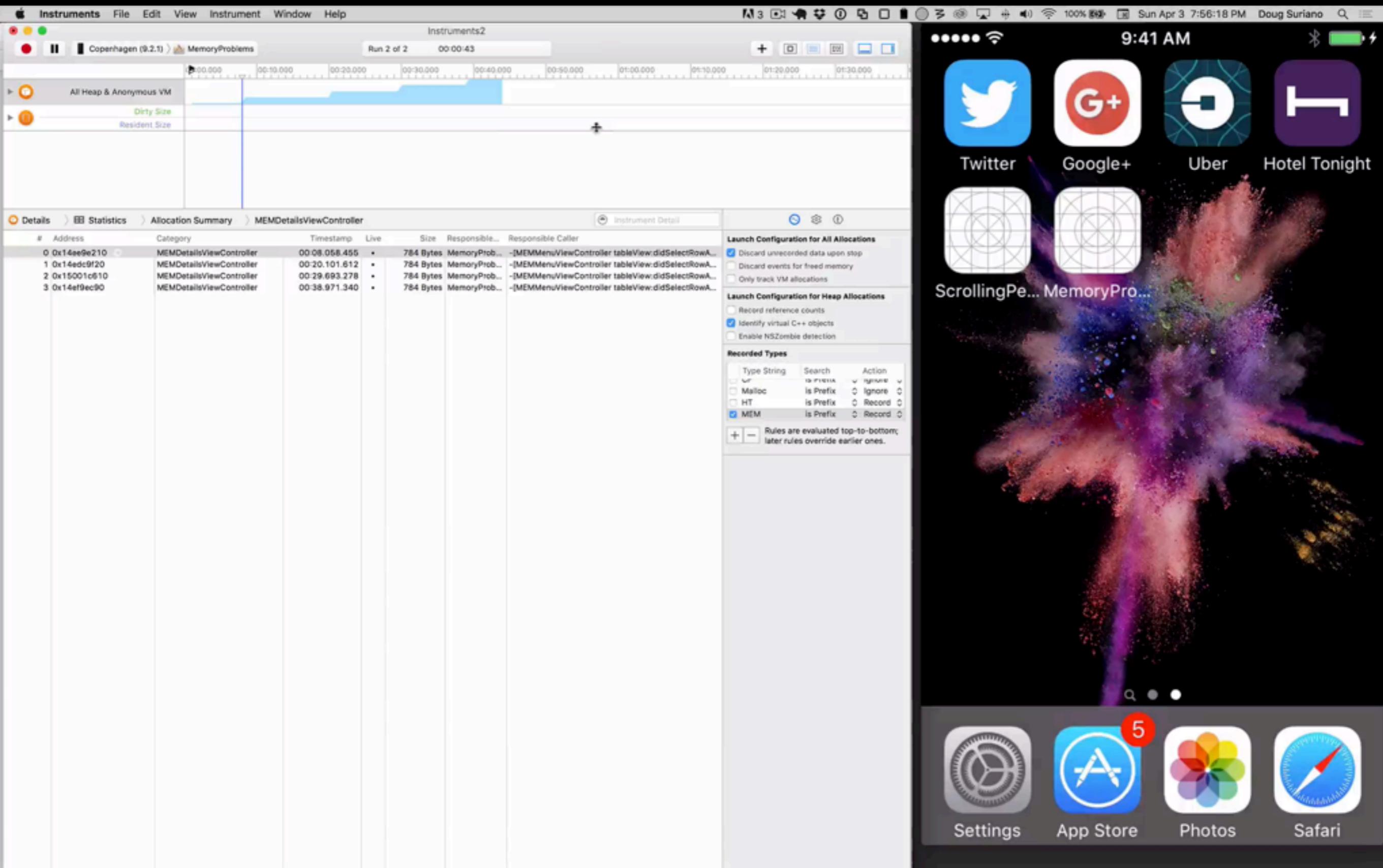
Details

Statistics

Allocation Summary

Graph	Category	Persistent Bytes	# Persistent	# Transient	Total Bytes	# Total	Transient/Total Bytes
<input checked="" type="checkbox"/>	All Heap & Anonymous V...	15.36 KB	36	0	15.36 KB	36	
<input type="checkbox"/>	All Heap Allocations	15.36 KB	36	0	15.36 KB	36	
<input type="checkbox"/>	MEMRickRollView	11.38 KB	28	0	11.38 KB	28	
<input type="checkbox"/>	MEMDetailsViewController	3.06 KB	4	0	3.06 KB	4	
<input type="checkbox"/>	MEMMenuViewController	848 Bytes	1	0	848 Bytes	1	
<input type="checkbox"/>	MEMMenuOption	64 Bytes	2	0	64 Bytes	2	
<input type="checkbox"/>	MEMAppDelegate	32 Bytes	1	0	32 Bytes	1	

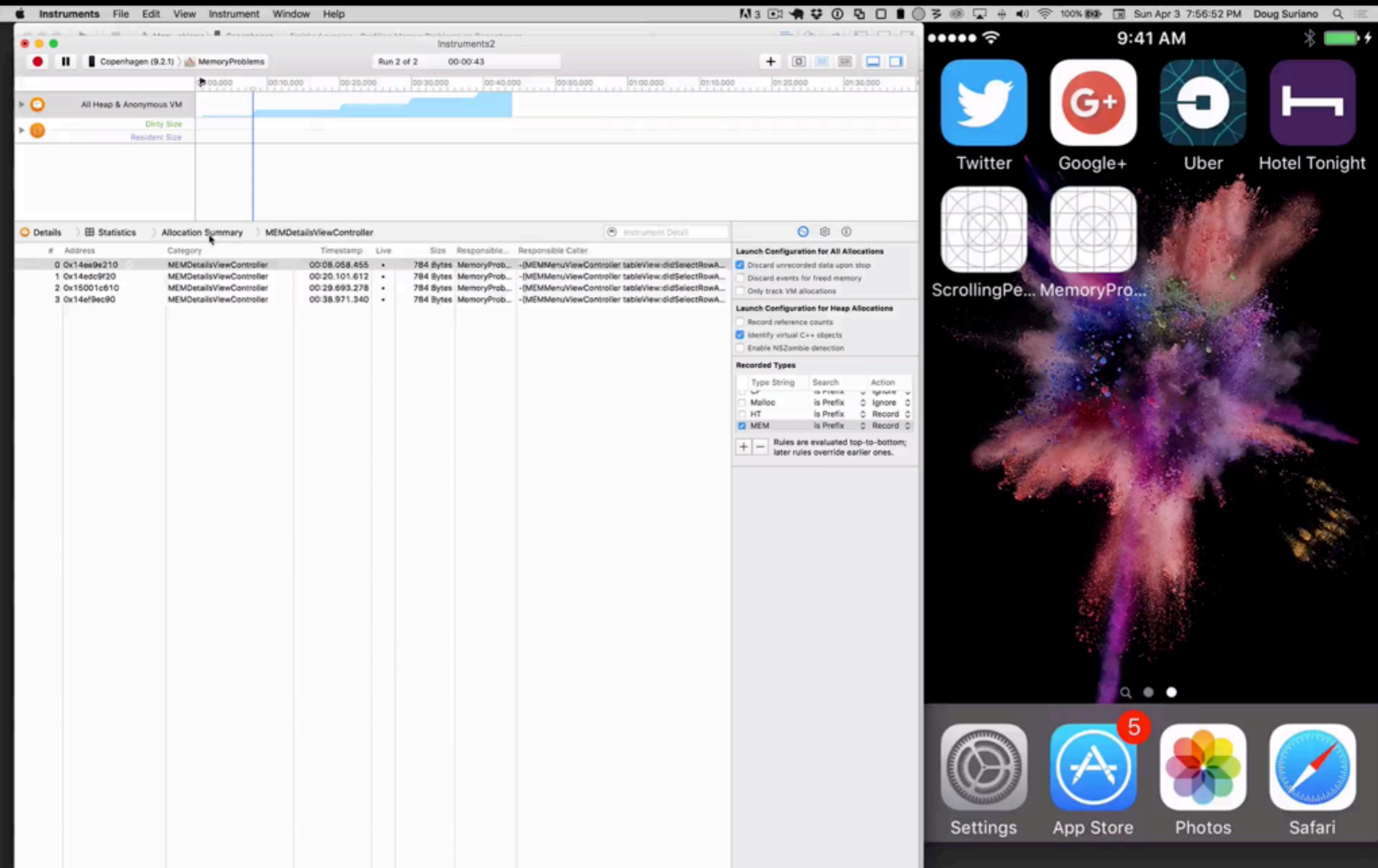




```
- (void)tableView:(UITableView *)tableView didSelectRowAtIndexPath:(NSIndexPath *)indexPath
{
    [tableView deselectRowAtIndexPath:indexPath animated:YES];

    MEMMenuOption *problem = self.menuItems[indexPath.row];

    switch (problem.optionItem)
    {
        case MEMMenuOptionItemOrderChickenWings:
        {
            MEMDetailsViewController *vc = [[MEMDetailsViewController alloc]
initWithNibName:nil bundle:nil];
            [self.navigationController pushViewController:vc animated:YES];
            break;
        }
        case MEMMenuOptionItemGetFreePony:
        {
            MEMImprovedDetailsViewController *vc = [[MEMImprovedDetailsViewController alloc]
initWithNibName:nil bundle:nil];
            [self.navigationController pushViewController:vc animated:YES];
            break;
        }
    }
}
```



Mac OS X desktop showing Instruments and iPhone screen.

Instruments (Left):

- Instrument: MemoryProblems
- Device: Copenhagen (9.2.1)
- Run 2 of 2, Duration: 00:00:43
- Timeline: Shows memory usage over time.
- Allocations Table (MEMRickRollView):

#	Address	Category	Timestamp	Live	Size	Responsible...	Responsible Caller
0	0x14ee06340	MEMRickRollView	00:08.086.861	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
1	0x14edcc3a0	MEMRickRollView	00:08.172.481	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
2	0x14eebdc50	MEMRickRollView	00:08.250.402	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
3	0x14eecbec0	MEMRickRollView	00:08.328.394	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
4	0x14edfb0b0	MEMRickRollView	00:08.392.023	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
5	0x14ef113a0	MEMRickRollView	00:08.455.509	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
6	0x14eecd10	MEMRickRollView	00:08.525.977	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
7	0x14eeffab0	MEMRickRollView	00:20.114.815	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
8	0x1500259e0	MEMRickRollView	00:20.206.887	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
9	0x14ef45110	MEMRickRollView	00:20.265.478	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
10	0x1500438a0	MEMRickRollView	00:20.324.972	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
11	0x150057a70	MEMRickRollView	00:20.387.054	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
12	0x14ef69d90	MEMRickRollView	00:20.446.159	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
13	0x150071e80	MEMRickRollView	00:20.505.367	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
14	0x150069390	MEMRickRollView	00:29.701.222	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
15	0x14efaf610	MEMRickRollView	00:29.783.453	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
16	0x14efbf52d0	MEMRickRollView	00:29.876.357	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
17	0x14efc7d10	MEMRickRollView	00:29.939.701	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
18	0x14efcdab0	MEMRickRollView	00:30.013.065	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
19	0x1500b5c10	MEMRickRollView	00:30.091.155	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
20	0x1500c3410	MEMRickRollView	00:30.152.865	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
21	0x14effd980	MEMRickRollView	00:38.980.896	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
22	0x1500ef260	MEMRickRollView	00:39.078.719	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
23	0x14efff0510	MEMRickRollView	00:39.154.896	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
24	0x15011da00	MEMRickRollView	00:39.217.556	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
25	0x1501251c0	MEMRickRollView	00:39.279.176	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
26	0x15013b2a0	MEMRickRollView	00:39.342.140	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)
27	0x1501488c0	MEMRickRollView	00:39.406.527	•	416 Bytes	MemoryProb...	-(MEMDetailsViewController rickRollUser)

iPhone Screen (Right):

- Time: 9:41 AM
- Icons visible: Twitter, Google+, Uber, Hotel Tonight.
- Background image: A colorful explosion or fireworks display.
- Bottom dock icons (with notification counts): Settings (5), App Store (5), Photos, Safari.

```
- (void)rickRollUser
{
    for (NSInteger i = 0; i < kNumberOfTimesToRickRollNSMeetup; i++)
    {
        // Choose a random X,Y position for the view
        CGFloat randomX = (CGFloat)arc4random_uniform(400);
        CGFloat randomY = (CGFloat)arc4random_uniform(450);
        CGRect rickRollFrame = CGRectMake(randomX, randomY,
self.view.frame.size.width, self.view.frame.size.height);

        MEMRickRollView *rickRollView = [[MEMRickRollView alloc]
initWithFrame:rickRollFrame];
        rickRollView.delegate = self;

        [self.view addSubview:rickRollView];
    }
}
```

```
rickRollView.delegate = self;
```

Xcode File Edit View Find Navigate Editor Product Debug Source Control Window Help

Mem...blems Copenhagen Finished running - Profiling MemoryProblems on Copenhagen

```
4 // Created by Doug Suriano on 4/3/16.
5 // Copyright © 2016 Hotel Tonight. All rights reserved.
6 //
7
8
9 #import "MEMDetailsViewController.h"
10 #import "MEMRickRollView.h"
11
12 static NSInteger const kNumberOfTimesToRickRollNSMeetup = 7;
13
14 @interface MEMDetailsViewController () <MEMRickRollViewDelegate>
15
16 @end
17
18 @implementation MEMDetailsViewController
19
20 - (void)viewDidLoad
21 {
22     [super viewDidLoad];
23
24     self.title = @"Never going to give you up";
25     self.view.backgroundColor = [UIColor blackColor];
26
27     [self rickRollUser];
28 }
29
30 - (void)rickRollUser
31 {
32     for (NSInteger i = 0; i < kNumberOfTimesToRickRollNSMeetup; i++)
33     {
34         // Choose a random X,Y position for the view
35         CGFloat randomX = (CGFloat)arc4random_uniform(400);
36         CGFloat randomY = (CGFloat)arc4random_uniform(450);
37         CGRect rickRollFrame = CGRectMake(randomX, randomY, self.view.frame.size.width, self.view.frame.size.height);
38
39         MEMRickRollView *rickRollView = [[MEMRickRollView alloc] initWithFrame:rickRollFrame];
40         rickRollView.delegate = self;
41
42         [self.view addSubview:rickRollView];
43     }
44 }
45
46 - (void)rickRollView:(MEMRickRollView *)view didRickRollUser:(BOOL)rickroll
47 {
48     if (rickroll)
49     {
50         NSLog(@"lolz");
51     }
52 }
53
54 @end
55
```

9:41 AM

Twitter Google+ Uber Hotel Tonight

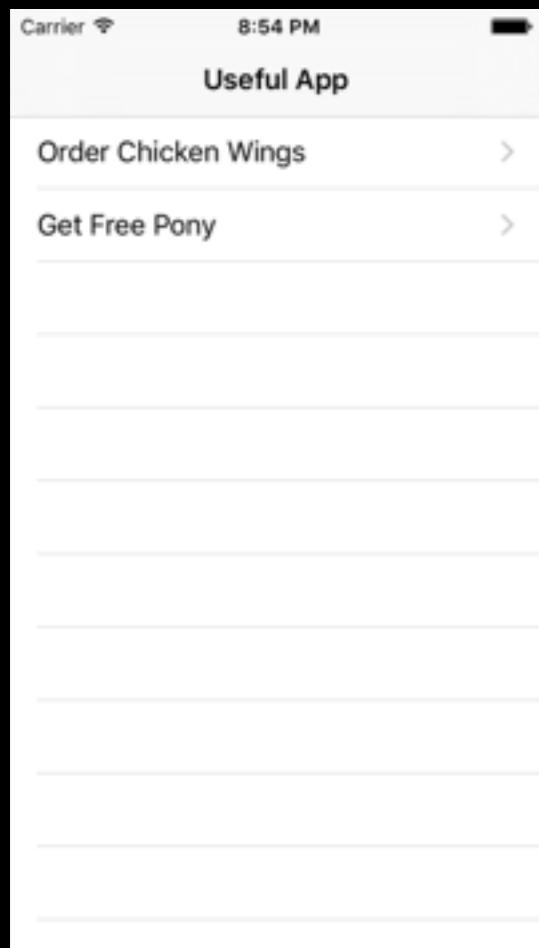
ScrollingPe... MemoryPro...

Settings App Store Photos Safari

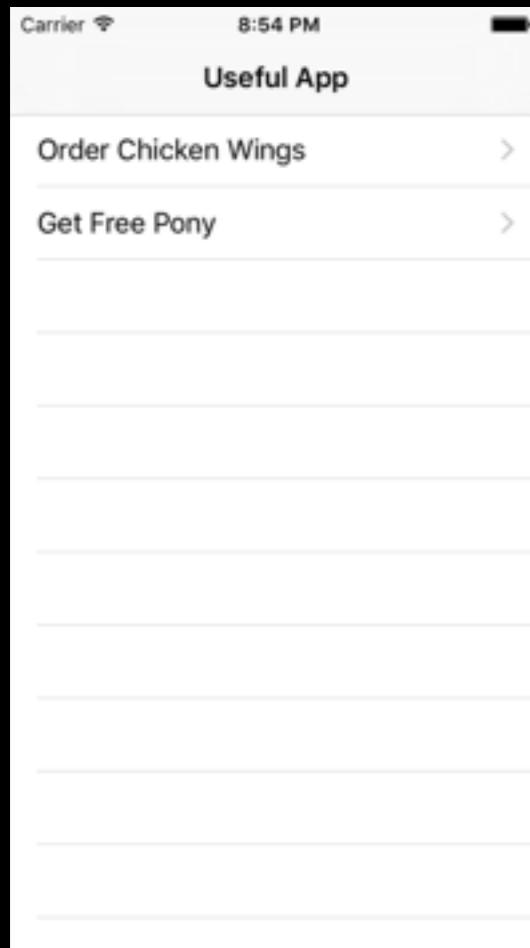
```
@property (nonatomic, strong) id<MEMRickRollViewDelegate> delegate;
```

(nonatomic, strong)

Ouch.



MEMMenuViewController

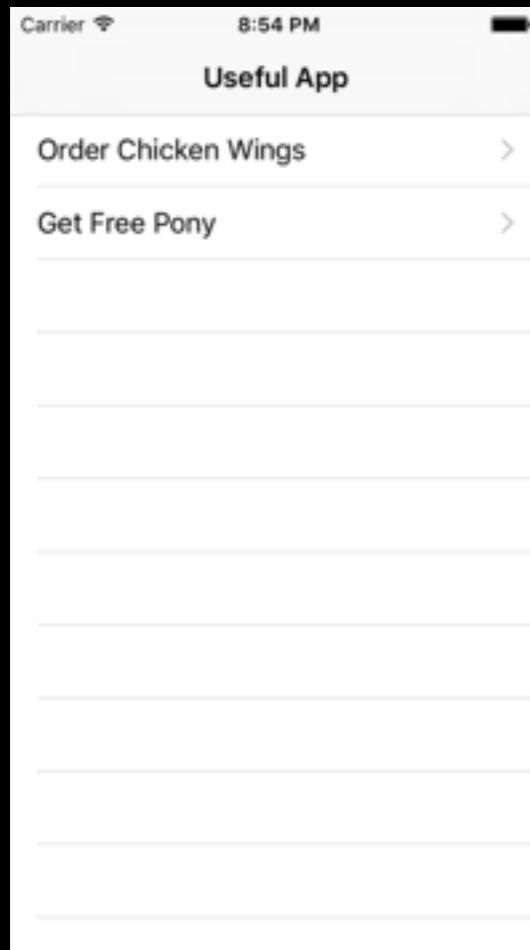


MEMMenuViewController



MEMDetailViewController

[self.viewControllers pushViewControllerAnimated:vc];



MEMMenuViewController

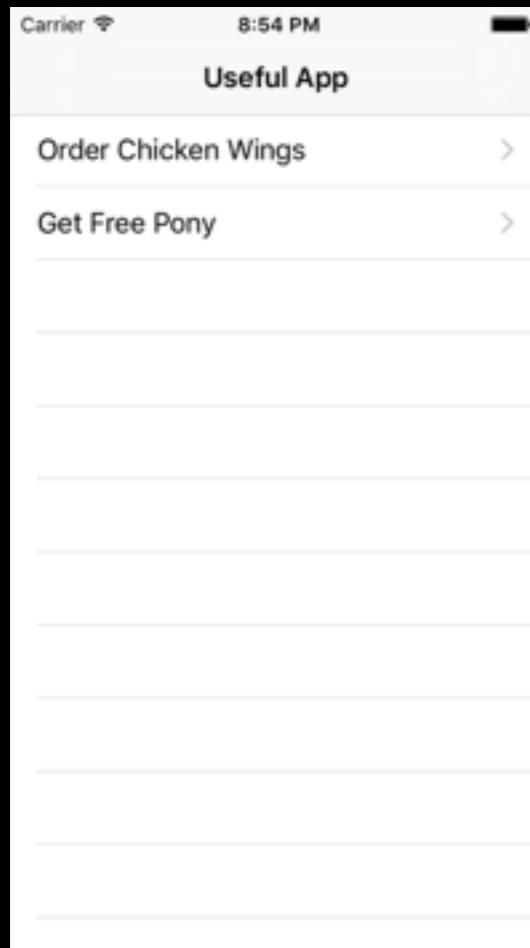


MEMDetailViewController



MEMRickRollView

[self.view addSubview:rickRollView]



MEMMenuViewController

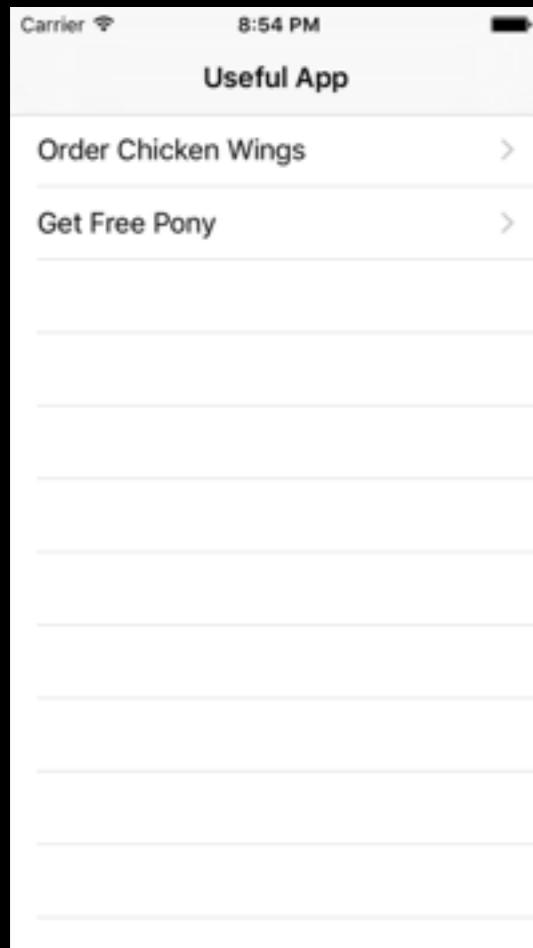


MEMDetailViewController



MEMRickRollView

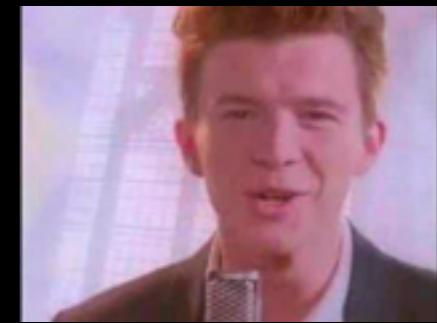
```
rickRollView.delegate = self/* MEMDetailsViewController */;
```



MEMMenuViewController

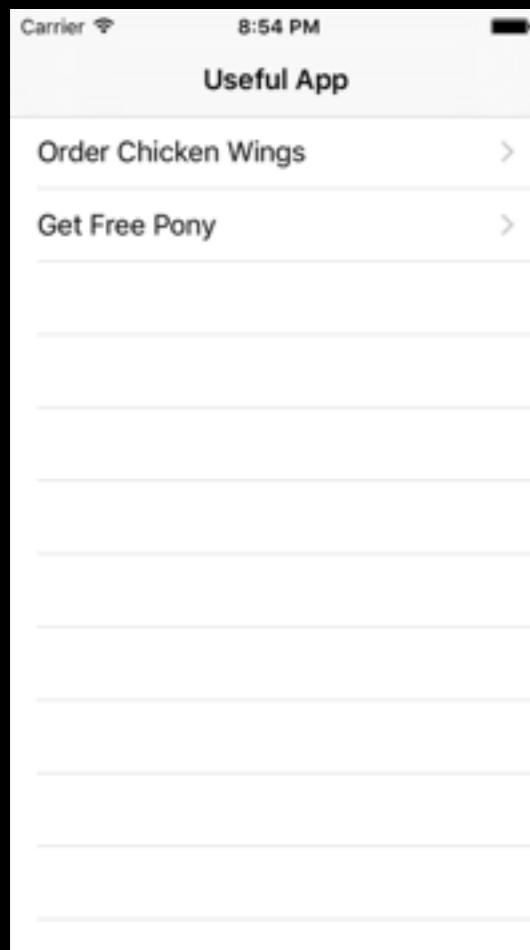


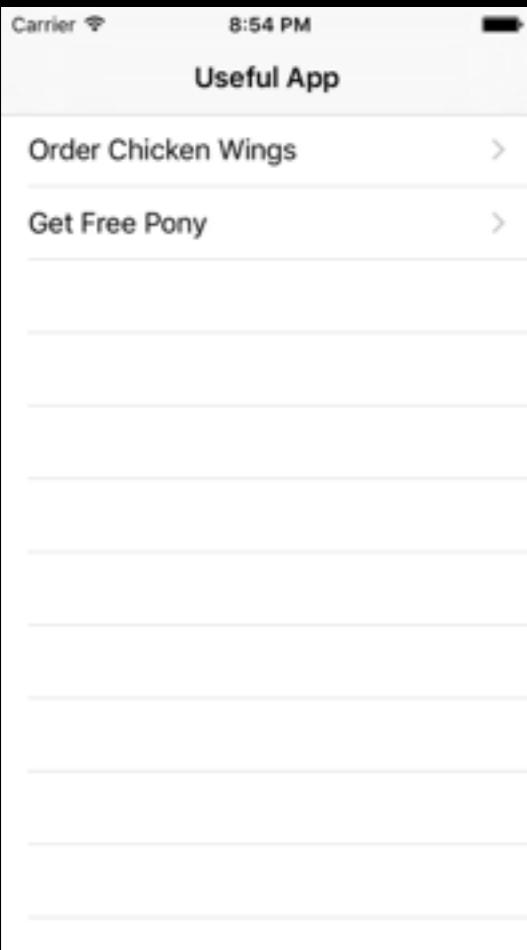
MEMDetailViewController



MEMRickRollView

```
[self.navigationController.popViewControllerAnimated:YES];
```



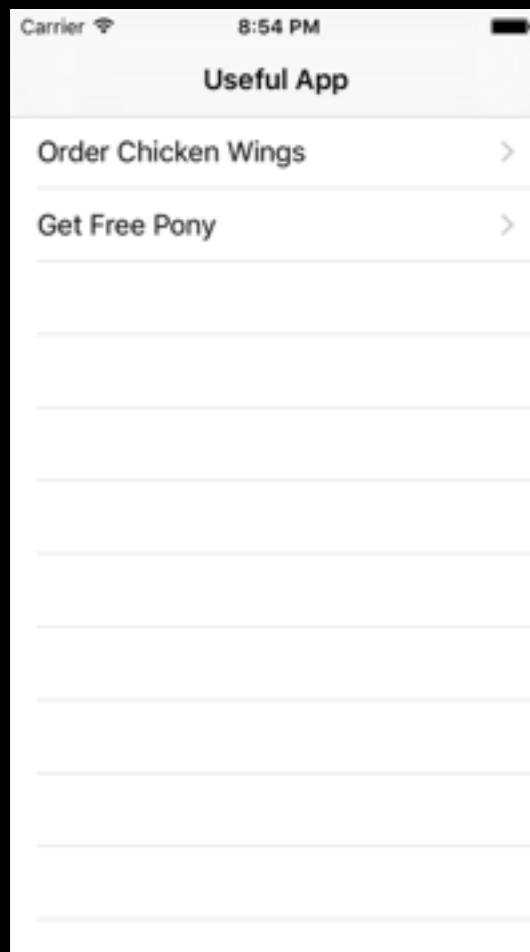


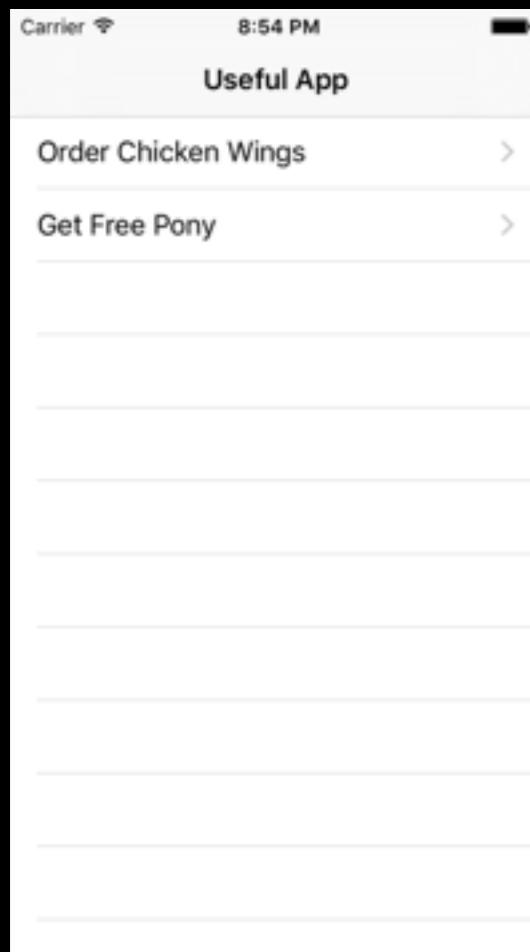
MEMMenuViewController

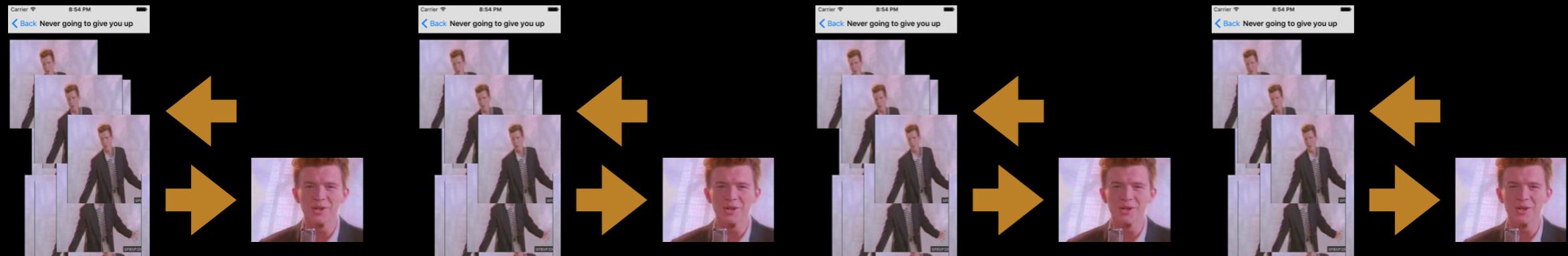
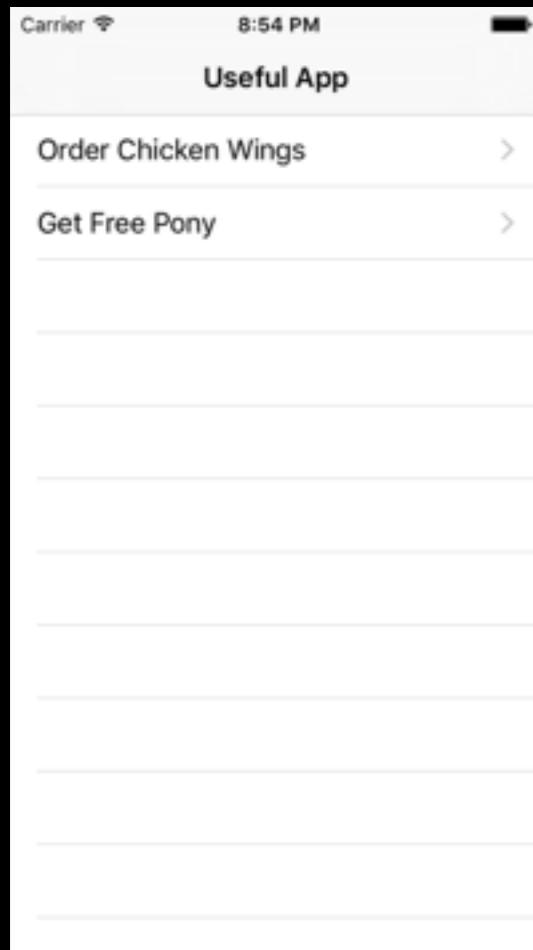
MEMDetailViewController

MEMRickRollView









Never going to
give you up indeed.

Xcode File Edit View Find Navigate Editor Product Debug Source Control Window Help

Mem...blems Copenhagen Finished running - Profiling MemoryProblems on Copenhagen

```
1 // MEMRickRollView.h
2 // MemoryProblems
3 //
4 // Created by Doug Suriano on 4/3/16.
5 // Copyright © 2016 Hotel Tonight. All rights reserved.
6 //
7 //
8
9 #import <UIKit/UIKit.h>
10
11 @class MEMRickRollView;
12
13 @protocol MEMRickRollViewDelegate <NSObject>
14
15 - (void)rickRollView:(MEMRickRollView *)view didRickRollUser:(BOOL)rickroll;
16
17 @end
18
19 @class FLAnimatedImageView;
20
21 @interface MEMRickRollView : UIView
22
23 @property (nonatomic, strong, readonly) FLAnimatedImageView *imageView1;
24 @property (nonatomic, strong, readonly) FLAnimatedImageView *imageView2;
25 @property (nonatomic, strong, readonly) FLAnimatedImageView *imageView3;
26 @property (nonatomic, strong, readonly) FLAnimatedImageView *imageView4;
27 @property (nonatomic, strong, readonly) FLAnimatedImageView *imageView5;
28 @property (nonatomic, strong) id<MEMRickRollViewDelegate> delegate;
29
30 @end
31
```

9:41 AM

The image shows an iPhone home screen with a vibrant, colorful explosion or fireworks effect as the background. At the top, there's a status bar with signal strength, battery level (100%), and the date/time (Sun Apr 3 7:57:30 PM). Below the status bar, the home screen displays several app icons: Twitter (blue), Google+ (red), Uber (teal), Hotel Tonight (purple), and two placeholder grid icons. At the bottom, the dock contains four more apps: Settings (grey), App Store (blue with a red notification badge showing '5'), Photos (colorful flower icon), and Safari (compass icon).

Xcode File Edit View Find Navigate Editor Product Debug Source Control Window Help

Mem...blems Copenhagen Finished running - Profiling MemoryProblems on Copenhagen

MemoryProblems MemoryProblems MEMRickRollView.h delegate

```
1 //  
2 // MEMRickRollView.h  
3 // MemoryProblems  
4 //  
5 // Created by Doug Suriano on 4/3/16.  
6 // Copyright © 2016 Hotel Tonight. All rights reserved.  
7 //  
8  
9 #import <UIKit/UIKit.h>  
10  
11 @class MEMRickRollView;  
12  
13 @protocol MEMRickRollViewDelegate <NSObject>  
14  
15 - (void)rickRollView:(MEMRickRollView *)view didRickRollUser:(BOOL)rickroll;  
16  
17 @end  
18  
19 @class FLAnimatedImageView;  
20  
21 @interface MEMRickRollView : UIView  
22  
23 @property (nonatomic, strong, readonly) FLAnimatedImageView *imageView1;  
24 @property (nonatomic, strong, readonly) FLAnimatedImageView *imageView2;  
25 @property (nonatomic, strong, readonly) FLAnimatedImageView *imageView3;  
26 @property (nonatomic, strong, readonly) FLAnimatedImageView *imageView4;  
27 @property (nonatomic, strong, readonly) FLAnimatedImageView *imageView5;  
28 @property (nonatomic, weak) id<MEMRickRollViewDelegate> delegate;  
29  
30 @end  
31
```

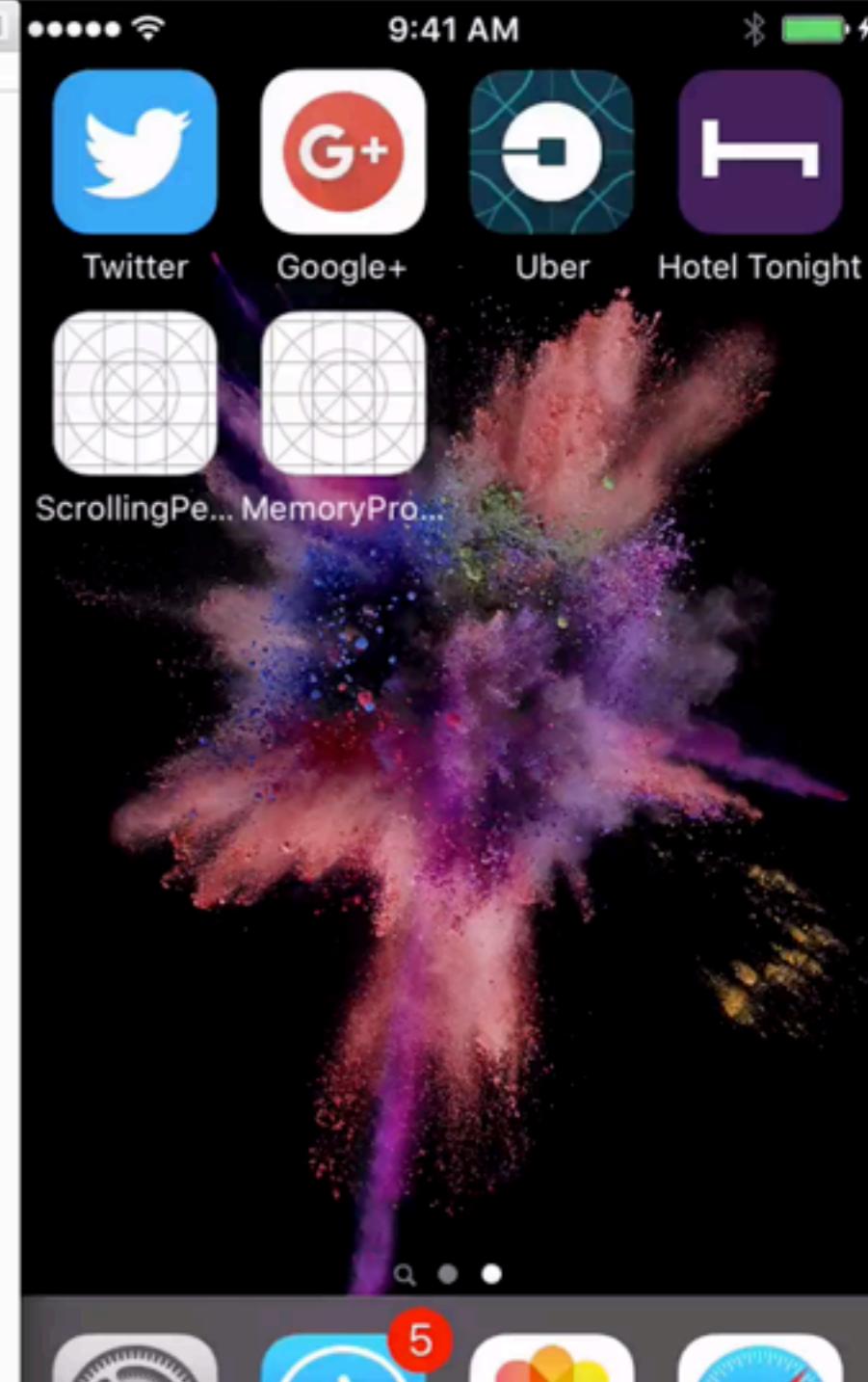
9:41 AM

Twitter Google+ Uber Hotel Tonight

ScrollingPe... MemoryPro...

Settings App Store Photos Safari

5



strong delegate....

strong delegate....

....really?

blocks.

Blocks.

(Or Closures)

Xcode warns me
right?

```
// MEMBetterDetailsViewController.m

@property (nonatomic, assign) BOOL didSyncUserInfo;

@property (nonatomic, strong) MEMUserInfo *userInfo;

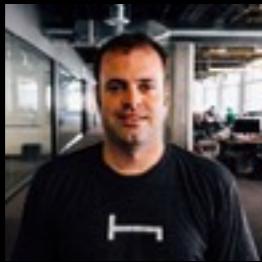
- (void)createUserInfo
{
    MEMUserInfo *userInfo = [MEMUserInfo new];
    userInfo.postNetworkRequestUpdateBlock = ^{
        self.didSyncUserInfo = YES;
    };

    self.userInfo = userInfo;
}
```

```
weak MEMImprovedDetailsViewController *weakSelf = self;  
userInfo.postNetworkRequestUpdateBlock = ^{  
    weakSelf.didSyncUserInfo = YES;  
};
```

Custom Instruments





What powers
Instruments?

DTrace!

DTrace?

- Developed by Sun Microsystems for Solaris
- Dynamic Tracing Framework
- Was Added to Mac OS X 10.5 - Leopard

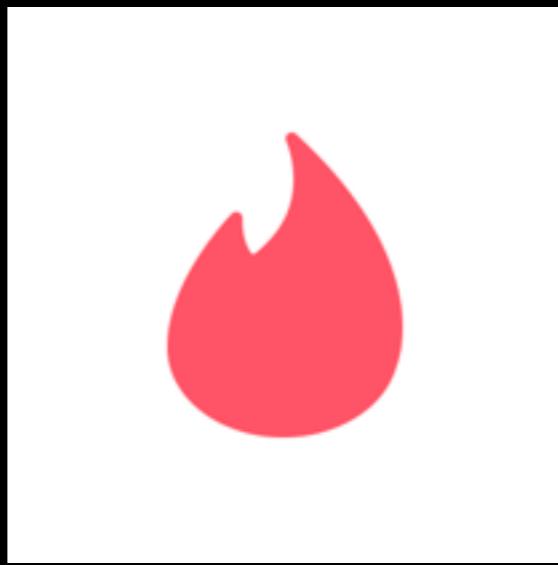
How do I use it?

- Write Probes - Measurements/Actions
- D Programming Language
- Probes have no performance cost if not enabled (with caveats)
- Super advanced & very comprehensive.

iOS Limitations

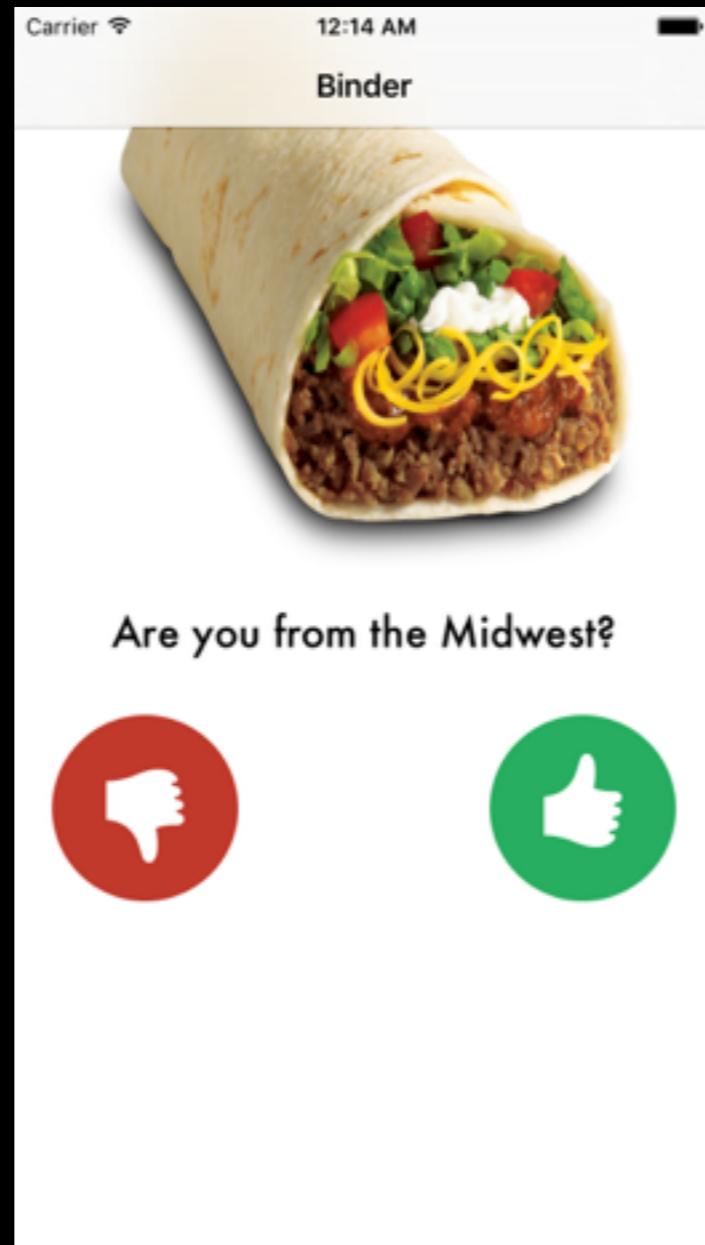
- DTrace is only available on OS X
-despite the fact Apple uses it for the instruments for iOS.
- We can use the simulator!

Let's build a simple
instrument to measure
an app's behavior





Binder



Binder

- Objective-C App
- Single View Controller
- Burritos are awesome

Let's measure every
time we log analytics!

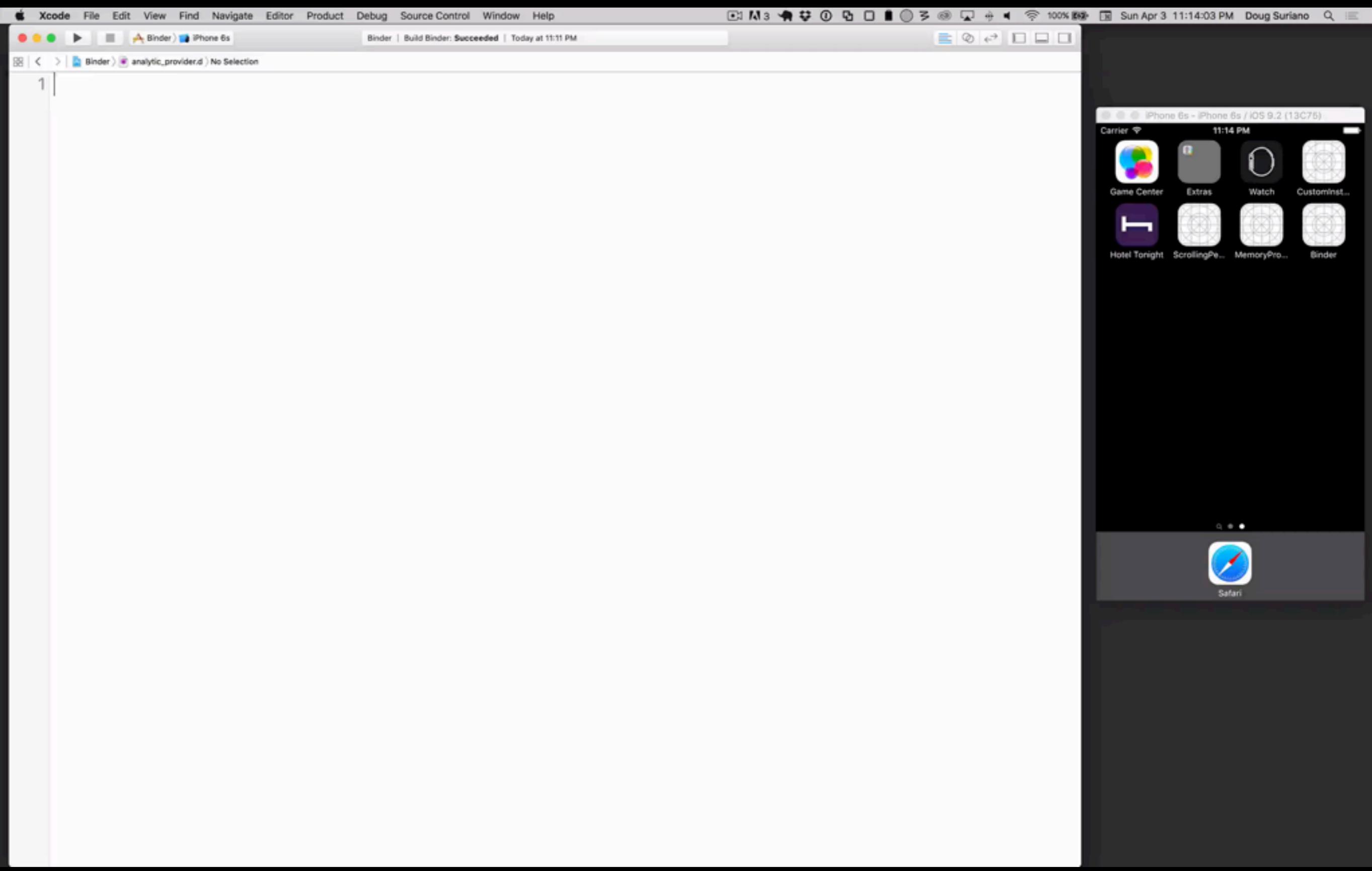
Let's measure every time we log analytics!

```
- (void)trackEventName:(NSString *)eventName  
                  params:(NSDictionary *)params  
{  
    [ThisMonthsAnalyticServiceOfChoice trackEvent:eventName  
                                              parameters:params];  
}
```

1. Event Name

```
- (void)trackEventName:(NSString *)eventName  
                  params:(NSDictionary *)params  
{  
    [ThisMonthsAnalyticServiceOfChoice trackEvent:eventName  
                                              parameters:params];  
}
```

1. Event Name
2. Number of keys in params



Xcode File Edit View Find Navigate Editor Product Debug Source Control Window Help

Binder | Build Binder: Succeeded | Today at 11:11 PM

Binder > analytic_provider.d No Selection

```
1 provider analytics {  
2  
3 };
```

iPhone 6s - iPhone 6s / iOS 8.2 (13C75)
Carrier 11:14 PM
Game Center Extras Watch Custominst...
Hotel Tonight ScrollingPe... MemoryPro... Binder
Safari

The screenshot shows the Xcode interface with a code editor containing a provider definition for 'analytics'. The code consists of three lines: 'provider analytics {', '}', and '}'. Below the code editor is a preview of an iPhone 6s running iOS 8.2. The home screen displays several app icons, including Game Center, Extras, Watch, Custominst..., Hotel Tonight, ScrollingPe..., MemoryPro..., Binder, and Safari. The Binder app icon is visible on both the code editor and the simulator screen.

Xcode File Edit View Find Navigate Editor Product Debug Source Control Window Help

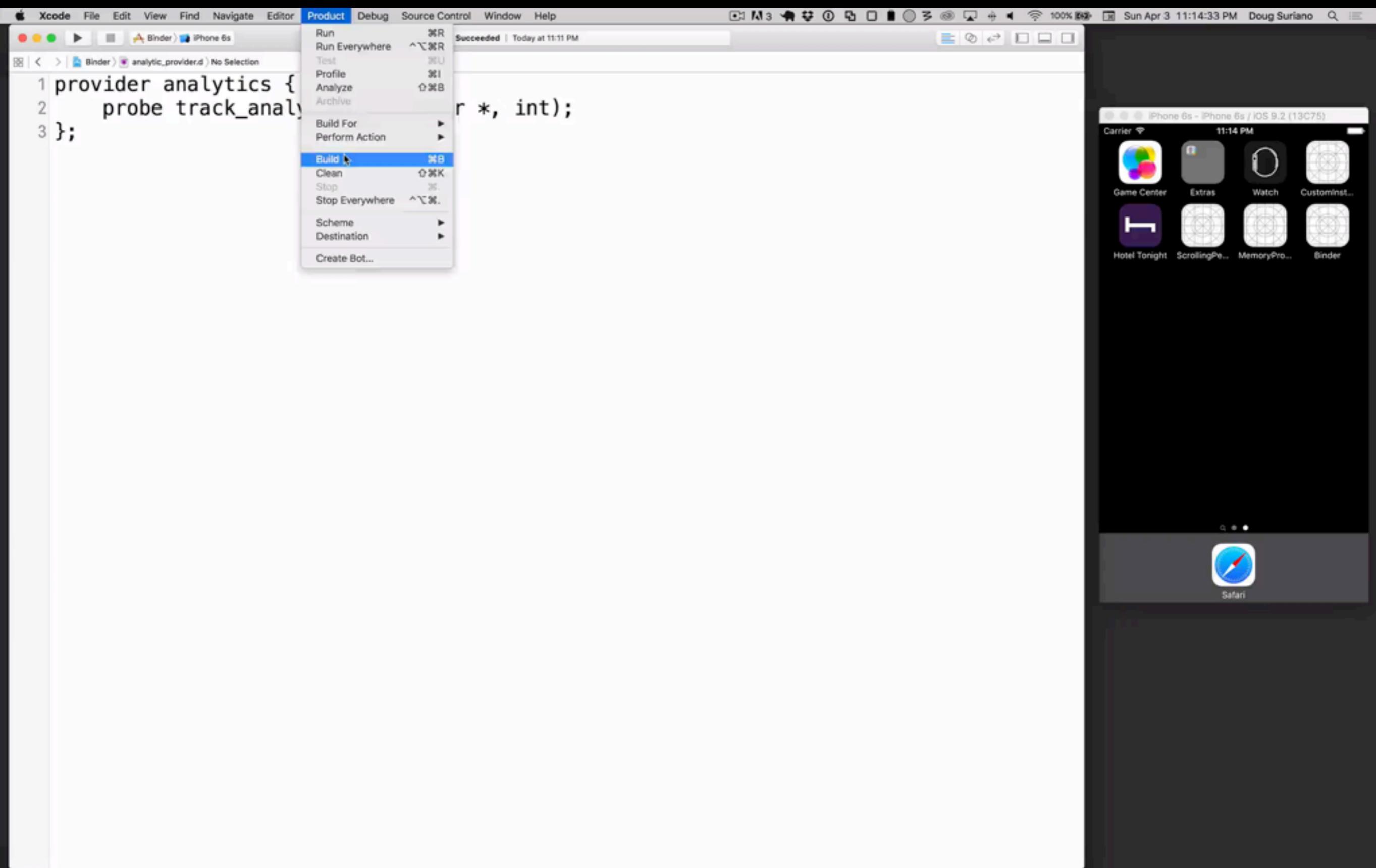
Binder | Build Binder: Succeeded | Today at 11:11 PM

Binder analytic_provider.d No Selection

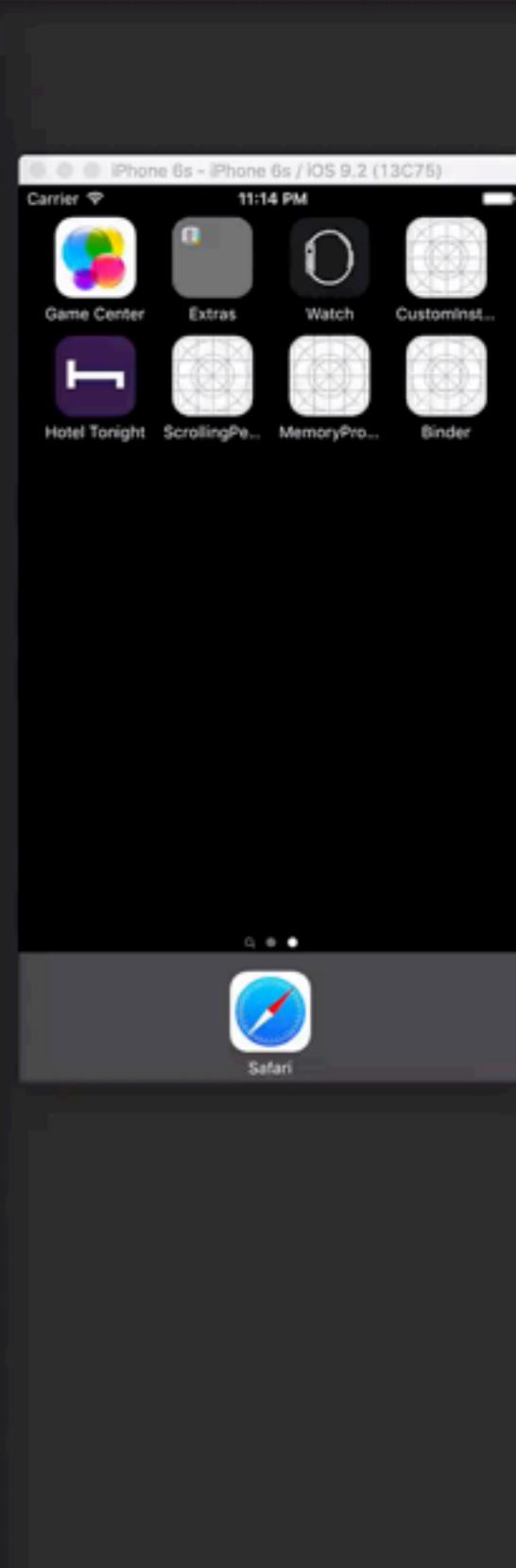
```
1 provider analytics {  
2     probe track_analytic_call(char *, int);  
3 };
```

iPhone 6s - iPhone 6s / iOS 9.2 (13C75)
Carrier 11:14 PM
Game Center Extras Watch Custominst...
Hotel Tonight ScrollingPe... MemoryPro... Binder
Safari

The screenshot shows the Xcode interface with a code editor containing a provider definition for 'analytics'. The provider has a single probe named 'track_analytic_call' that takes a character pointer and an integer as parameters. Below the code editor is a preview of an iPhone 6s running iOS 9.2. The home screen displays several app icons: Game Center, Extras, Watch, Custominst..., Hotel Tonight, ScrollingPe..., MemoryPro..., Binder, and Safari. The status bar at the top right indicates the carrier is 'Carrier', the time is '11:14 PM', and the build status is 'Build Binder: Succeeded'.

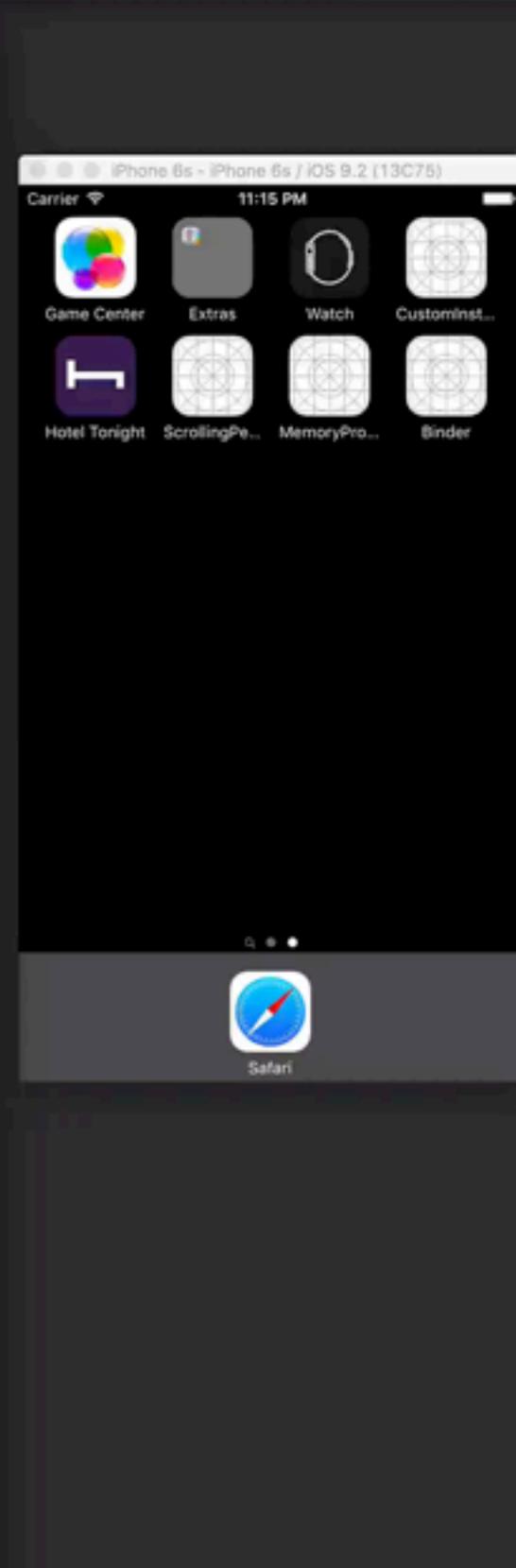


```
Xcode File Edit View Find Navigate Editor Product Debug Source Control Window Help
Binder | Build Binder: Succeeded | Today at 11:14 PM
Sun Apr 3 11:14:47 PM Doug Suriano
X Binder iPhone 6s
Binder | Build Binder: Succeeded | Today at 11:14 PM
No Selection
1 // BDRMatcherAnalytics.m
2 // Binder
3 //
4 //
5 // Created by Doug Suriano on 4/3/16.
6 // Copyright © 2016 Binder inc. All rights reserved.
7 //
8
9 #import "BDRMatcherAnalytics.h"
10 #import "ThisMonthsAnalyticServiceOfChoice.h"
11
12 @implementation BDRMatcherAnalytics
13
14 + (instancetype)sharedAnalytics
15 {
16     static dispatch_once_t onceToken;
17     static BDRMatcherAnalytics *_sharedAnalytics = nil;
18     dispatch_once(&onceToken, ^{
19         _sharedAnalytics = [[BDRMatcherAnalytics alloc] init];
20     });
21
22     return _sharedAnalytics;
23 }
24
25 - (void)trackEventName:(NSString *)eventName params:(NSDictionary *)params
26 {
27     [ThisMonthsAnalyticServiceOfChoice trackEvent:eventName parameters:params];
28 }
29
30 @end
31
```

The image shows an iPhone 6s simulator running iOS 9.2 (13C75). The screen displays the home screen with several app icons: Game Center, Extras, Watch, Custominst..., Hotel Tonight, ScrollingPe..., MemoryPro..., and Binder. The status bar at the top indicates the carrier is 'Carrier', the time is '11:14 PM', and there is a signal strength icon.

```
Xcode File Edit View Find Navigate Editor Product Debug Source Control Window Help
Binder | Build Binder: Succeeded | Today at 11:14 PM
Sun Apr 3 11:15:03 PM Doug Suriano
X Binder iPhone 6s
Binder | Build Binder: Succeeded | Today at 11:14 PM
Binder > Binder > BDRMatcherAnalytics.m @implementation BDRMatcherAnalytics

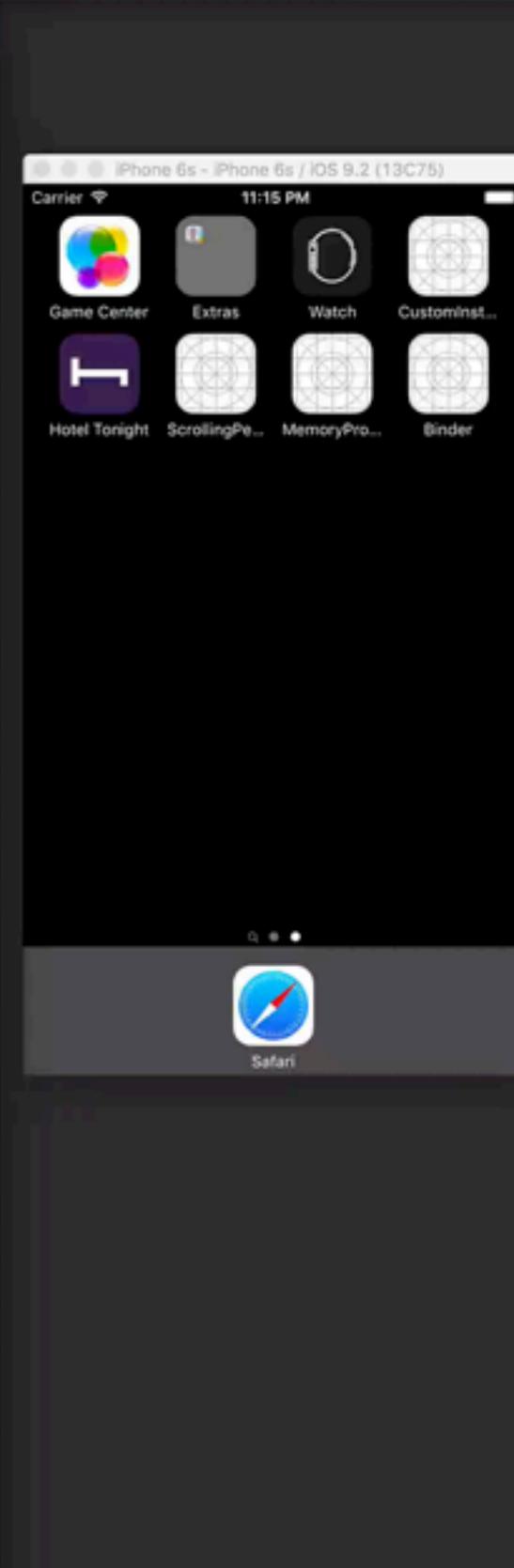
1 // Binder
2 // BDRMatcherAnalytics.m
3 // Created by Doug Suriano on 4/3/16.
4 // Copyright © 2016 Binder inc. All rights reserved.
5 //
6
7
8
9 #import "BDRMatcherAnalytics.h"
10 #import "ThisMonthsAnalyticServiceOfChoice.h"
11 #import "analytic_provider.h"
12
13 @implementation BDRMatcherAnalytics
14
15 + (instancetype)sharedAnalytics
16 {
17     static dispatch_once_t onceToken;
18     static BDRMatcherAnalytics *_sharedAnalytics = nil;
19     dispatch_once(&onceToken, ^{
20         _sharedAnalytics = [[BDRMatcherAnalytics alloc] init];
21     });
22
23     return _sharedAnalytics;
24 }
25
26 - (void)trackEventName:(NSString *)eventName params:(NSDictionary *)params
27 {
28     [ThisMonthsAnalyticServiceOfChoice trackEvent:eventName parameters:params];
29 }
30
31 @end
32
```

The image shows an iPhone 6s simulator running iOS 9.2 (13C75). The screen displays the home screen with several app icons: Game Center, Extras, Watch, Custominst..., Hotel Tonight, ScrollingPe..., MemoryPro..., and Binder. The time on the device is 11:15 PM. A navigation bar at the top indicates the device is an iPhone 6s with carrier connectivity and battery level.

ANALYTICS_TRACK_ANALYTIC_CALL_ENABLED()

ANALYTICS_TRACK_ANALYTIC_CALL(arg0, arg1)

```
Xcode File Edit View Find Navigate Editor Product Debug Source Control Window Help
Binder | Build Binder: Succeeded | Today at 11:14 PM
1 // BDRMatcherAnalytics.m
2 // Binder
3 //
4 //
5 // Created by Doug Suriano on 4/3/16.
6 // Copyright © 2016 Binder inc. All rights reserved.
7 //
8
9 #import "BDRMatcherAnalytics.h"
10 #import "ThisMonthsAnalyticServiceOfChoice.h"
11 #import "analytic_provider.h"
12
13 @implementation BDRMatcherAnalytics
14
15 + (instancetype)sharedAnalytics
16 {
17     static dispatch_once_t onceToken;
18     static BDRMatcherAnalytics *_sharedAnalytics = nil;
19     dispatch_once(&onceToken, ^{
20         _sharedAnalytics = [[BDRMatcherAnalytics alloc] init];
21     });
22
23     return _sharedAnalytics;
24 }
25
26 - (void)trackEventName:(NSString *)eventName params:(NSDictionary *)params
27 {
28     [ThisMonthsAnalyticServiceOfChoice trackEvent:eventName parameters:params];
29 }
30
31 @end
32
```



The screenshot shows an iPhone 6s simulator running iOS 9.2 (13C75). The device is connected to a carrier and has a signal strength of 11:15 PM. The home screen displays several app icons: Game Center, Extras, Watch, Custominst..., Hotel Tonight, ScrollingPe..., MemoryPro..., and Binder. A Safari icon is visible in the dock at the bottom.

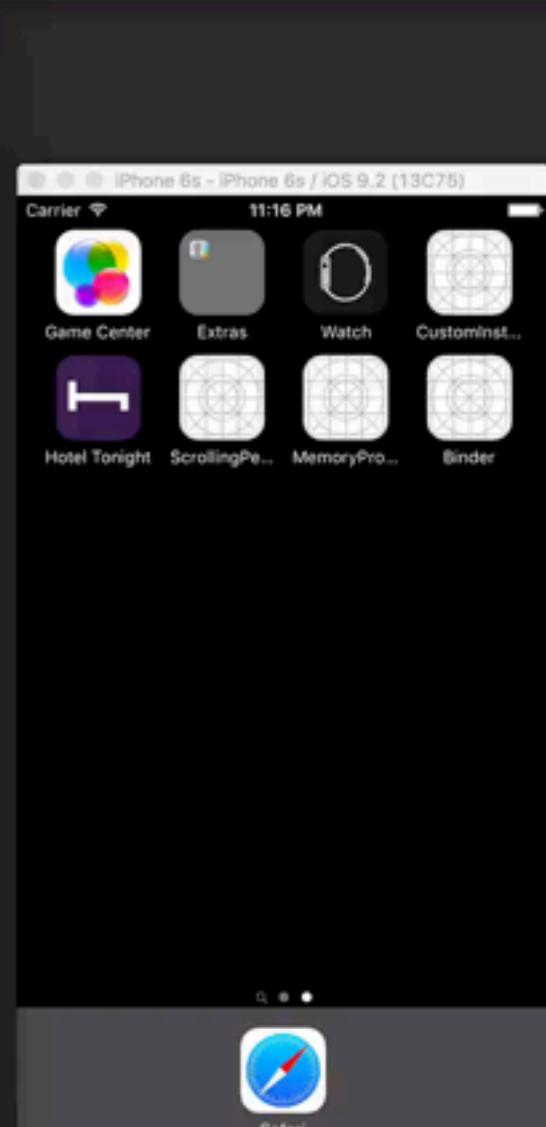
```
Xcode File Edit View Find Navigate Editor Product Debug Source Control Window Help
Binder | Build Binder: Succeeded | Today at 11:14 PM
Sun Apr 3 11:15:40 PM Doug Suriano
Xcode iPhone 6s
Binder | Build Binder: Succeeded | Today at 11:14 PM
File Edit View Find Navigator Editor Product Debug Source Control Window Help
iPhone 6s - iPhone 6s / iOS 9.2 (13C75)
Carrier 11:15 PM
Game Center Extras Watch Custominst...
Hotel Tonight ScrollingPe... MemoryPro... Binder
Safari
```

Binder | Build Binder: Succeeded | Today at 11:14 PM

Binder | Build Binder: Succeeded | Today at 11:14 PM

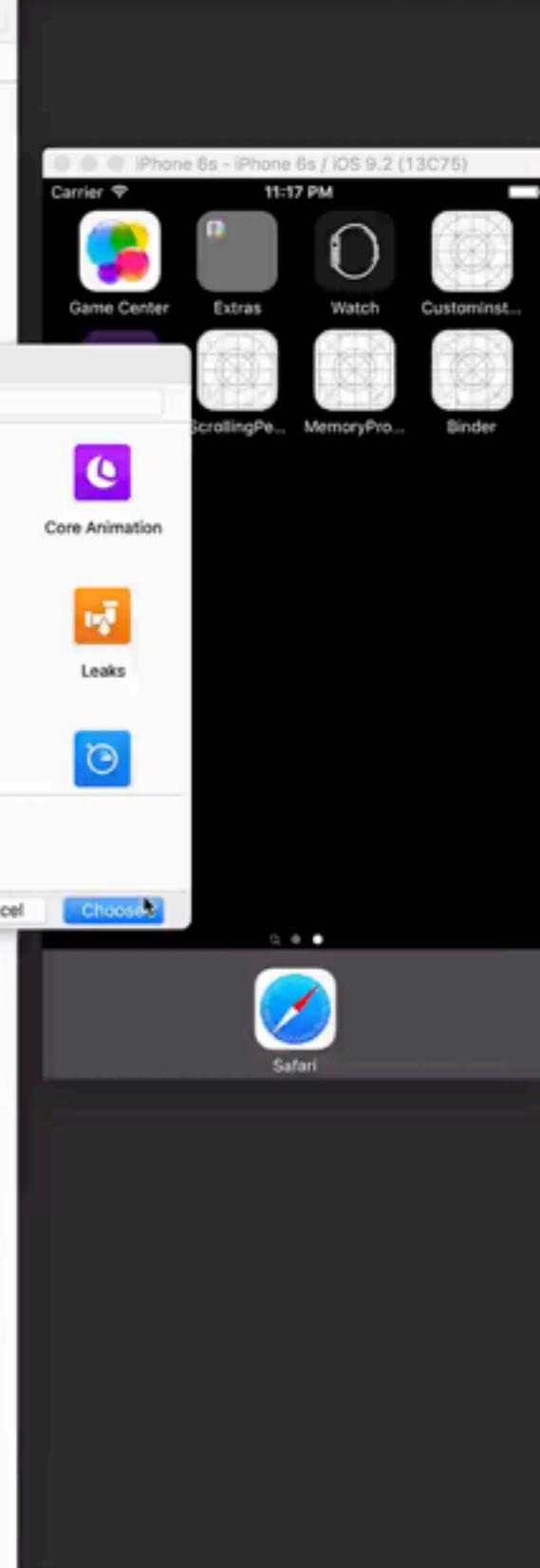
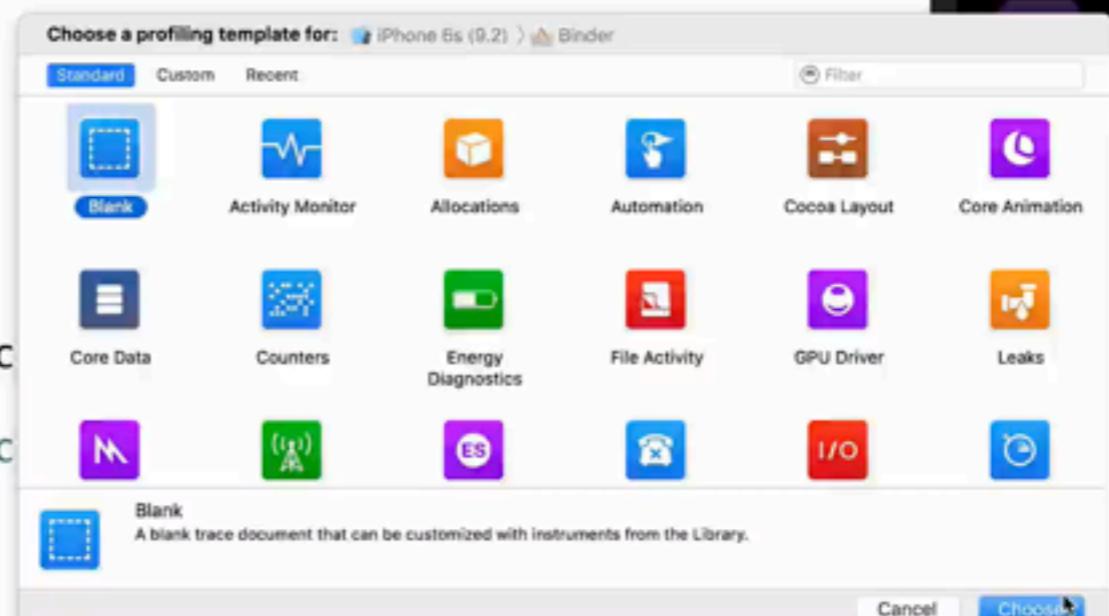
1 //
2 // BDRMatcherAnalytics.m
3 // Binder
4 //
5 // Created by Doug Suriano on 4/3/16.
6 // Copyright © 2016 Binder inc. All rights reserved.
7 //
8
9 #import "BDRMatcherAnalytics.h"
10 #import "ThisMonthsAnalyticServiceOfChoice.h"
11 #import "analytic_provider.h"
12
13 @implementation BDRMatcherAnalytics
14
15 + (instancetype)sharedAnalytics
16 {
17 static dispatch_once_t onceToken;
18 static BDRMatcherAnalytics *_sharedAnalytics = nil;
19 dispatch_once(&onceToken, ^{
20 _sharedAnalytics = [[BDRMatcherAnalytics alloc] init];
21 });
22
23 return _sharedAnalytics;
24 }
25
26 - (void)trackEventName:(NSString *)eventName params:(NSDictionary *)params
27 {
28 [ThisMonthsAnalyticServiceOfChoice trackEvent:eventName parameters:params];
29
30 if (ANALYTICS_TRACK_ANALYTIC_CALL_ENABLED())
31 {
32 }
33 }
34 }

```
Xcode File Edit View Find Navigate Editor Product Debug Source Control Window Help
Binder iPhone 6s Finished running Binder on iPhone 6s
Binder > Binder > BDRMatcherAnalytics.m -trackEventName:params:
3 // Binder
4 //
5 // Created by Doug Suriano on 4/3/16.
6 // Copyright © 2016 Binder inc. All rights reserved.
7 //
8
9 #import "BDRMatcherAnalytics.h"
10 #import "ThisMonthsAnalyticServiceOfChoice.h"
11 #import "analytic_provider.h"
12
13 @implementation BDRMatcherAnalytics
14
15 + (instancetype)sharedAnalytics
16 {
17     static dispatch_once_t onceToken;
18     static BDRMatcherAnalytics *_sharedAnalytics = nil;
19     dispatch_once(&onceToken, ^{
20         _sharedAnalytics = [[BDRMatcherAnalytics alloc] init];
21     });
22
23     return _sharedAnalytics;
24 }
25
26 - (void)trackEventName:(NSString *)eventName params:(NSDictionary *)params
27 {
28     [ThisMonthsAnalyticServiceOfChoice trackEvent:eventName parameters:params];
29
30     if (ANALYTICS_TRACK_ANALYTIC_CALL_ENABLED())
31     {
32         ANALYTICS_TRACK_ANALYTIC_CALL(eventName.UTF8String, (int)params.allKeys.
33             count);
34     }
35 }
```



The screenshot shows an iPhone 6s simulator running iOS 9.2. The home screen displays several app icons: Game Center, Extras, Watch, Custominst..., Hotel Tonight, ScrollingPe..., MemoryPro..., and Binder. The Binder app icon is clearly visible. The status bar at the top right indicates the time is 11:16 PM. A small window in the bottom right corner shows the Safari browser icon.

```
5 // Created by doug suriano on 4/3/16.
6 // Copyright © 2016 Binder inc. All rights reserved.
7 //
8
9 #import "BDRMatcherAnalytics.h"
10 #import "ThisMonthsAnalyticServiceOfChoice.h"
11 #import "analytic_provider.h"
12
13 @implementation BDRMatcherAnalytics
14
15 + (instancetype)sharedAnalytics
16 {
17     static dispatch_once_t onceToken;
18     static BDRMatcherAnalytics *_sharedAnalytics;
19     dispatch_once(&onceToken, ^{
20         _sharedAnalytics = [[BDRMatcherAnalytics alloc] init];
21     });
22
23     return _sharedAnalytics;
24 }
25
26 - (void)trackEventName:(NSString *)eventName params:(NSDictionary *)params
27 {
28     [ThisMonthsAnalyticServiceOfChoice trackEvent:eventName parameters:params];
29
30     if (ANALYTICS_TRACK_ANALYTIC_CALL_ENABLED())
31     {
32         ANALYTICS_TRACK_ANALYTIC_CALL(eventName.UTF8String, (int)params.allKeys.
33             count);
34     }
35
36 @end
37
```



3.21 binuer

Run 0 of 0

00:00:00

+

00:00.000	00:10.000	00:20.000	00:30.000	00:40.000	00:50.000	01:00.000	01:10.000	01:20.000
-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------

 Instrument Detail

No

9.2) > Binder Run 0 of 0 00:00:00 +

Name: **Binder Analytic Param Check** Category: Custom Instruments Description: DTrace Instrument (Created Sun 04/03/16 11:18 PM)

DATA

BEGIN

Probe 1 - pid : : : entry

If the following conditions are met:

Probe **Probe 1** of type **User Process** hits Library Function entry +

Perform the following script:

+ - User Stack Trace ↴

Preserve previous instrument and recorded data

Cancel Save

9.2) > Binder Run 0 of 0 00:00:00 +

Name: Binder Analytic Param Check Category: Custom Instruments Description: DTrace Instrument (Created Sun 04/03/16 11:18 PM)

DATA

BEGIN

Probe 1 - pid : : : entry

If the following conditions are met:

Probe **Analytics** of type User Process hits Library Function entry +

Perform the following script:

+ - User Stack Trace ↴

Preserve previous instrument and recorded data

9.2) > Binder Run 0 of 0 00:00:00 +

Name: Category:

Description:

DATA

BEGIN

Analytics - : : :

If the following conditions are met:

Probe of type Provider Module Function Name

Perform the following script:

+ - User Stack Trace

Preserve previous instrument and recorded data

9.2) > Binder Run 0 of 0 00:00:00 +

Name: Binder Analytic Param Check Category: Custom Instruments Description: DTrace Instrument (Created Sun 04/03/16 11:18 PM) 

DATA

BEGIN

Analytics - :Binder: :

If the following conditions are met:

Probe Analytics of type Custom Provider Binder Function Name +

Perform the following script:

+ - User Stack Trace ↴

Preserve previous instrument and recorded data Cancel Save

9.2) > Binder Run 0 of 0 00:00:00 +

Name: Binder Analytic Param Check Category: Custom Instruments Description: DTrace Instrument (Created Sun 04/03/16 11:18 PM)

DATA

BEGIN

Analytics - :Binder::track_analytic_call

If the following conditions are met:

Probe Analytics of type Custom Provider Binder Function track_analytic_call +

Perform the following script:

+ - User Stack Trace ↴

Preserve previous instrument and recorded data

Cancel Save

9.2) > Binder Run 0 of 0 00:00:00 +

Name: Binder Analytic Param Check Category: Custom Instruments Description: DTrace Instrument (Created Sun 04/03/16 11:18 PM) 

If the following conditions are met:

Probe Analytics of type Custom Provider Binder Function track_analytic_call +

Perform the following script:

Record the following data:

Record in Instruments Last Error # - +
Record No Data - +

END

+ - User Stack Trace

Preserve previous instrument and recorded data Cancel Save

9.2) > Binder Run 0 of 0 00:00:00 +

Name: Binder Analytic Param Check Category: Custom Instruments Description: DTrace Instrument (Created Sun 04/03/16 11:18 PM) 

If the following conditions are met:

Probe Analytics of type Custom Provider Binder Function track_analytic_call +

Perform the following script:

Record the following data:

Record in Instruments arg0 Event Name String - + Record No Data - +

END

+ - User Stack Trace

Preserve previous instrument and recorded data Cancel Save

Instruments File Edit View Instrument Window Help

Finished running - Profiling Binder on iPhone 6s

Binder > Binder > m BDRMatcherAnalytics.m -trackEventName:params:

```
5 // Created by doug suriano on 4/3/10.
6 // Copyright © 2016 Binder inc. All rights reserved.
7 //
8
9 #import "BDRMatcherAnalytics.h"
10 #import
11 #import
12
13 @impl
14
15 + (inst
16 {
17     sta
18     sta
19     dis
20 });
21
22
23
24 }
25
26 -(void
27 {
28     [Th
29
30     if
31     {
32
33     }
34 }
35
36 @end
37
```

Instruments2

Name: Binder Analytic Param Check Category: Custom Instruments

Description: DTrace Instrument (Created Sun 04/03/16 11:18 PM)

If the following conditions are met:

Probe Analytics of type Custom Provider Binder Function track_analytic_call

Perform the following script:

Record the following data:

Record in Instruments arg0 Event Name String

Record in Instruments arg1 # of Params String

Record No Data

END

User Stack Trace

Preserve previous instrument and recorded data

Cancel Save

Nothing to display.

iPhone 6s - iPhone 6s / iOS 9.2 (13C75)

Carrier 11:18 PM

Game Center Extras Watch Custominst...

Hotel Tonight ScrollingPe... MemoryPro... Binder

Safari

Save it!

Recommend Resources

- WWDC!
- Big Nerd Ranch
- objc.io
- Will post links on meetup.com page

Thanks!

@dougsuriano