

# Core iOS Application Architectural Patterns

Building apps, it's not just for breakfast anymore

Session 224  
Bill Dudney  
UIKit Engineer

# Introduction

# Introduction



Common Patterns

# Introduction

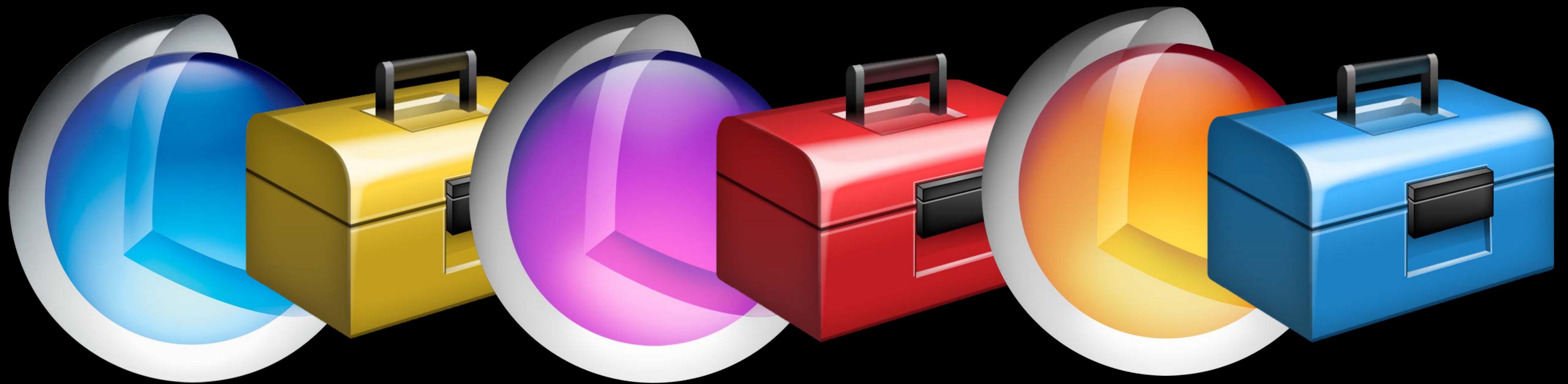
- 1 Common Patterns
- 2 Use Them in Your Code

# Common Patterns

UIKit and beyond

# Common Patterns

# Common Patterns



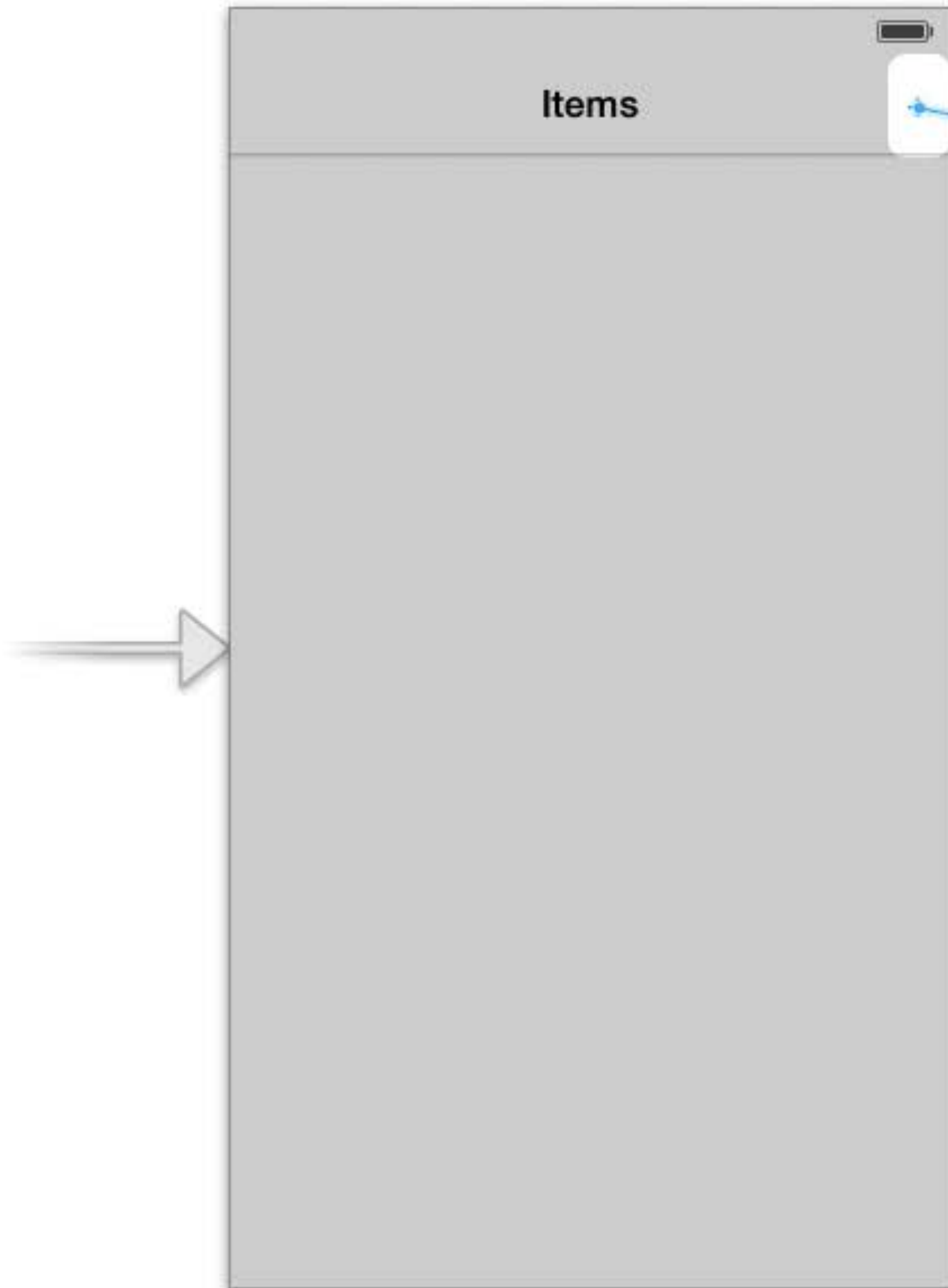
Target/Action



# Target/Action

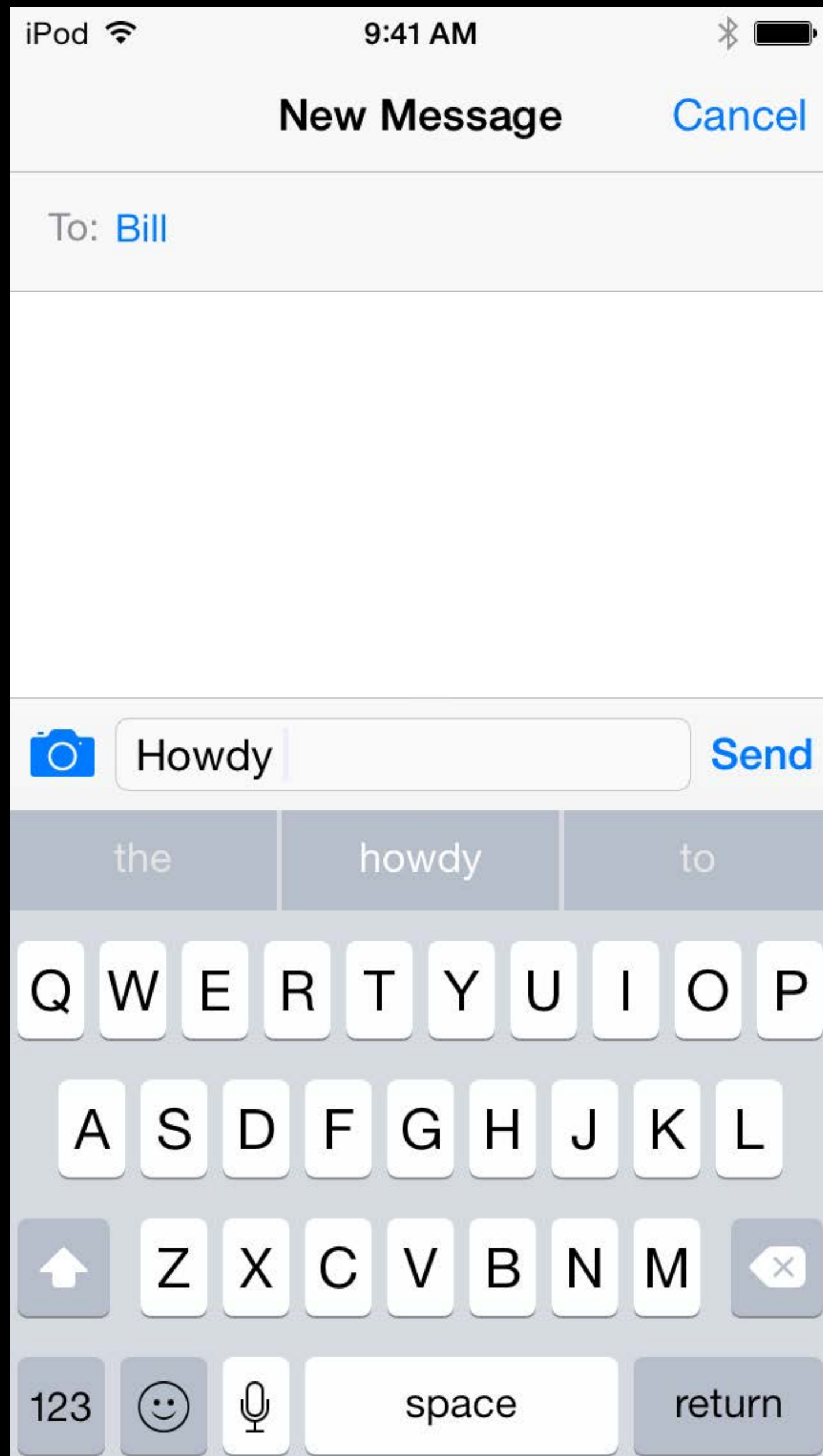
A consistent way to connect  
controls to custom logic

# Making a Connection

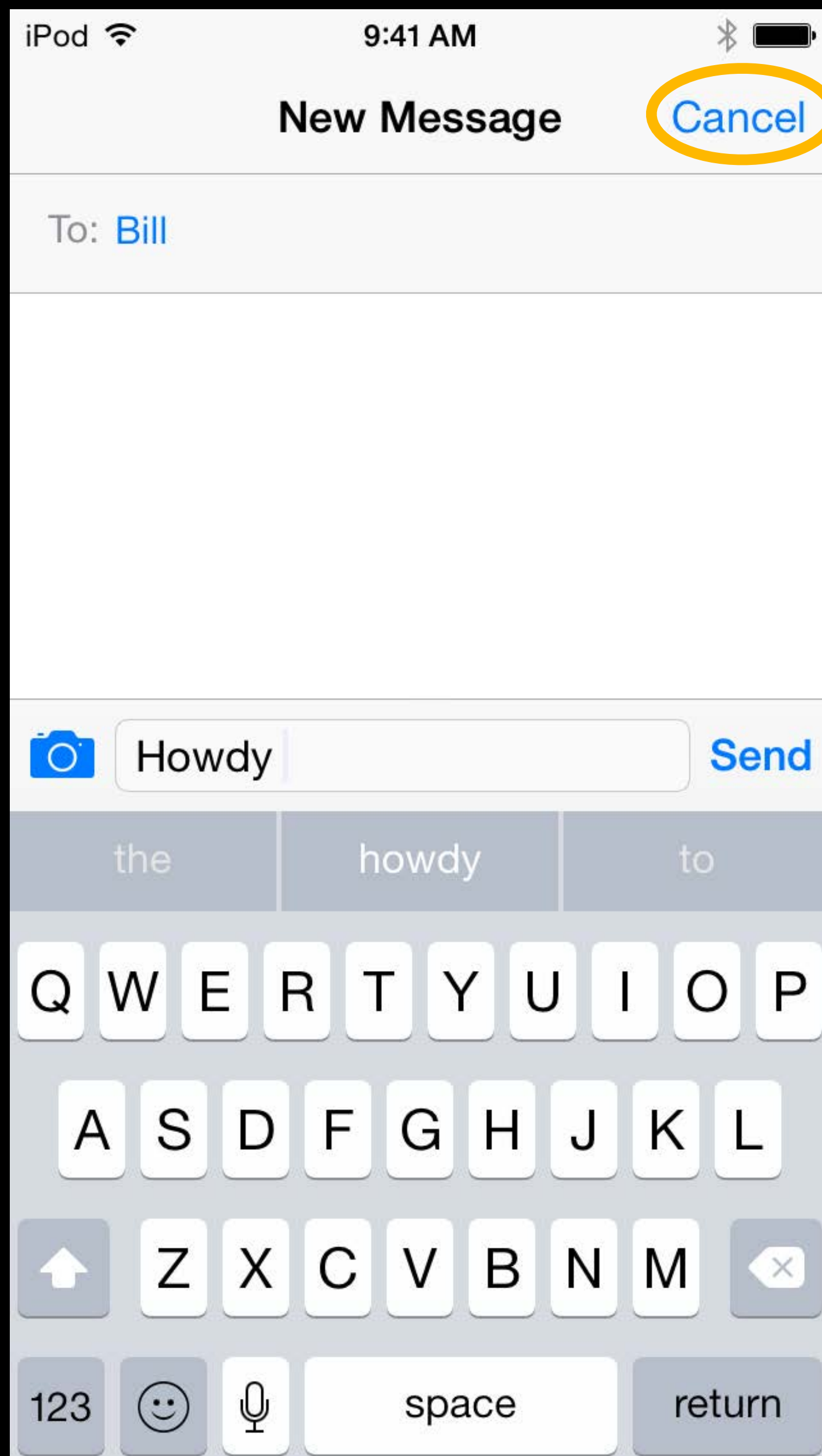


```
8
9 #import "ViewController.h"
10
11 @interface ViewController ()
12
13 @end
14
15 @implementation ViewController
16
17 - (IBAction)addItem:(id)sender {
18 }
19
20 - (void)viewDidLoad {
21     [super viewDidLoad];
22     // Do any additional setup after loading the view, typically from a nib.
23 }
24
25 - (void)didReceiveMemoryWarning {
26     [super didReceiveMemoryWarning];
27     // Dispose of any resources that can be recreated.
28 }
29
30 @end
31
```

# Target/Action

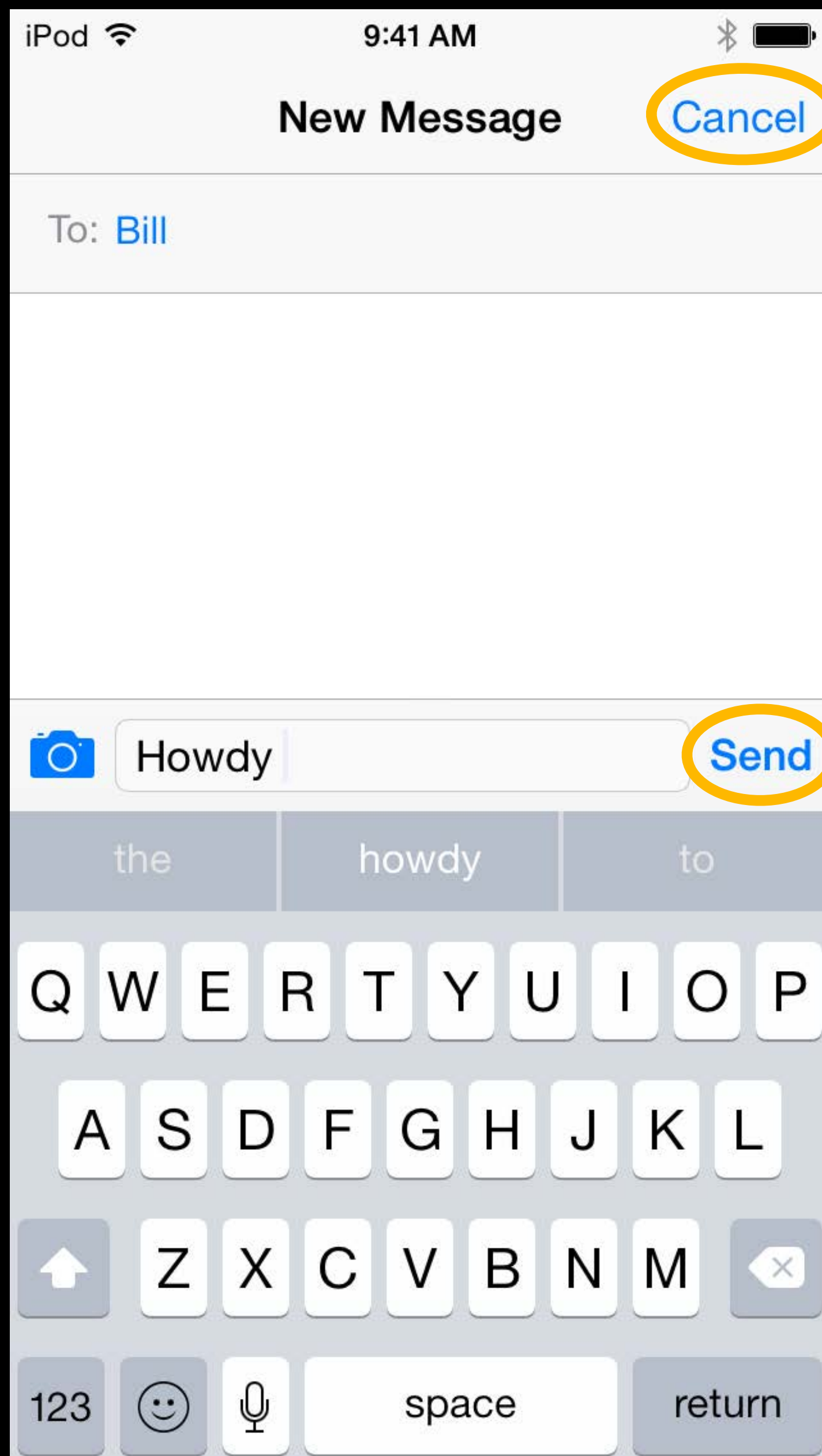


# Target/Action



Cancel Send

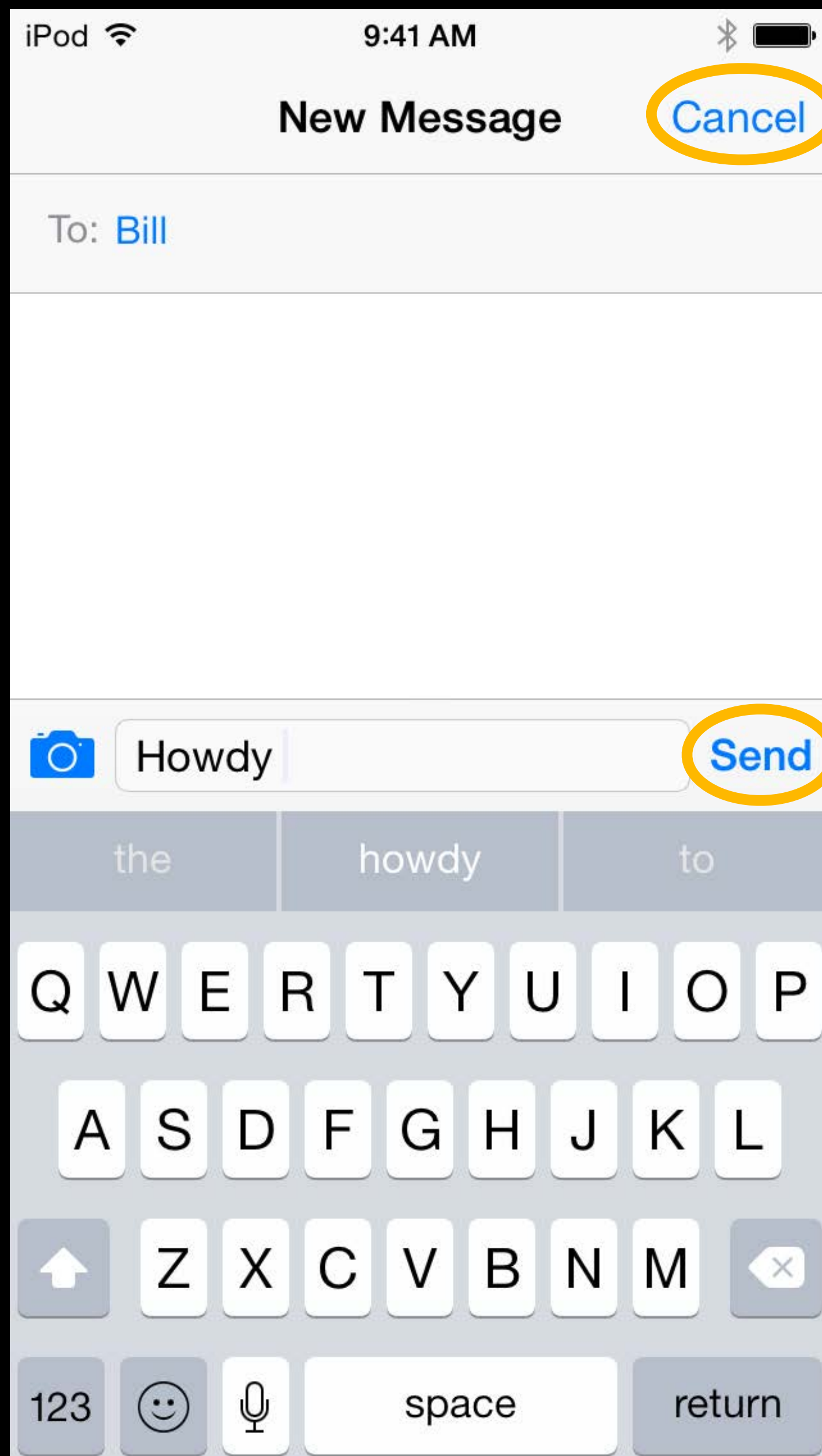
# Target/Action



Cancel Send

Send Message

# Target/Action



Cancel

UIBarButtonItem

Send

UIButton

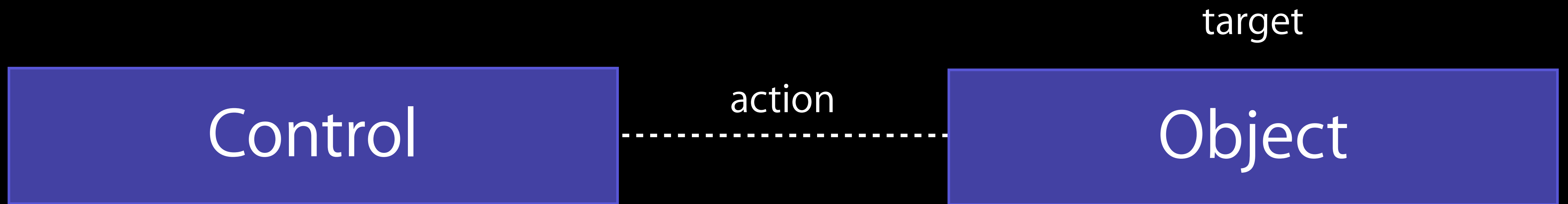
# Target/Action

Controls

Control

# Target/Action

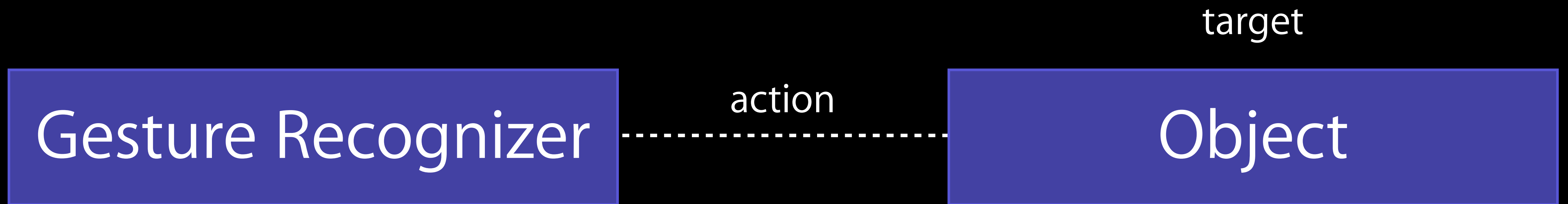
Controls





# Target/Action

Gesture Recognizers



Target/Action

# Responder Chain

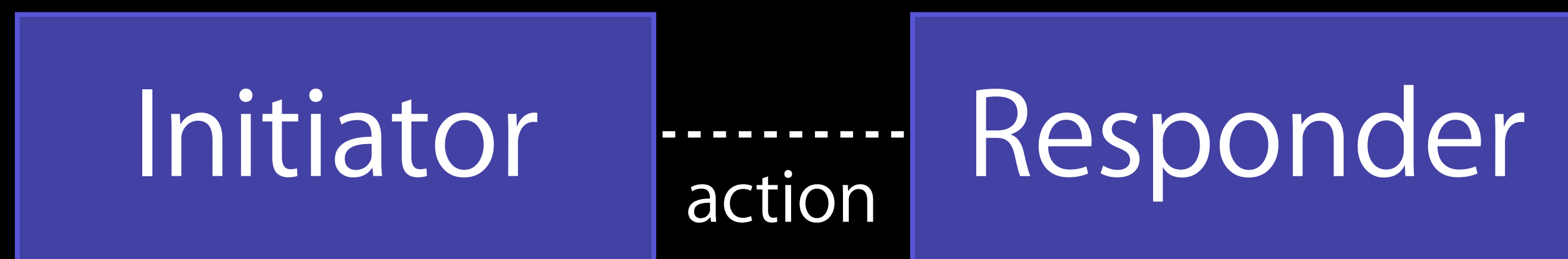
# Responder Chain

Handle events without knowledge  
of which object will be used

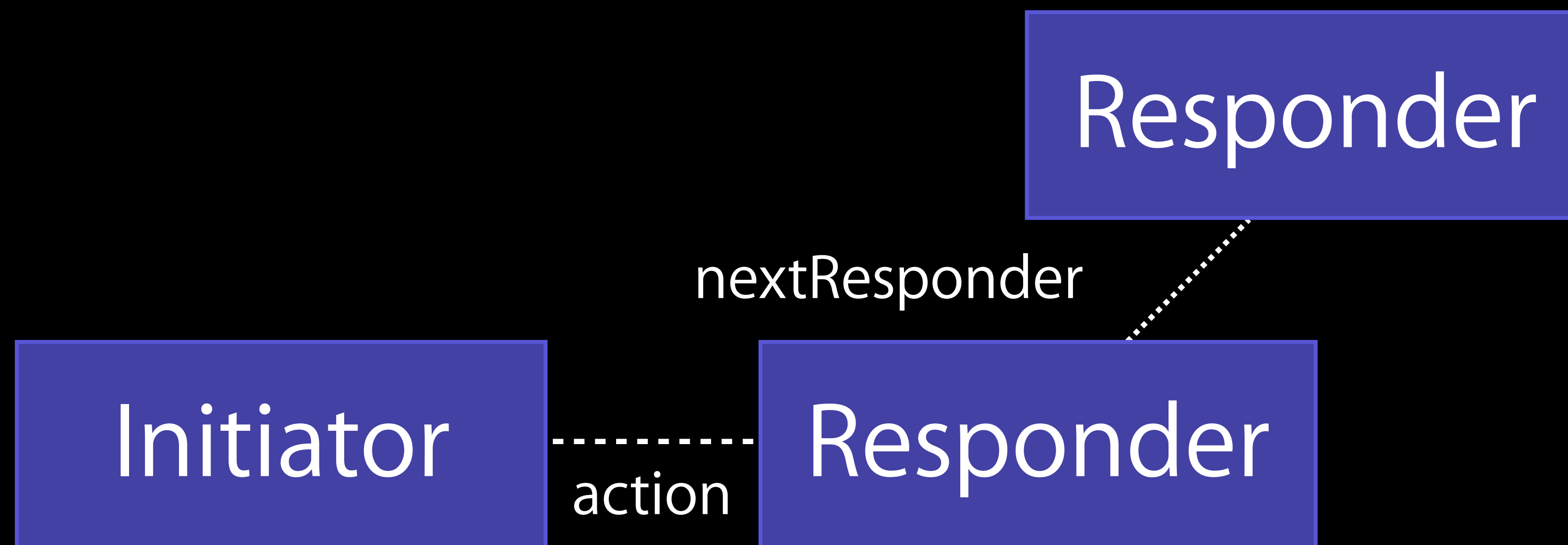
# Responder Chain

Initiator

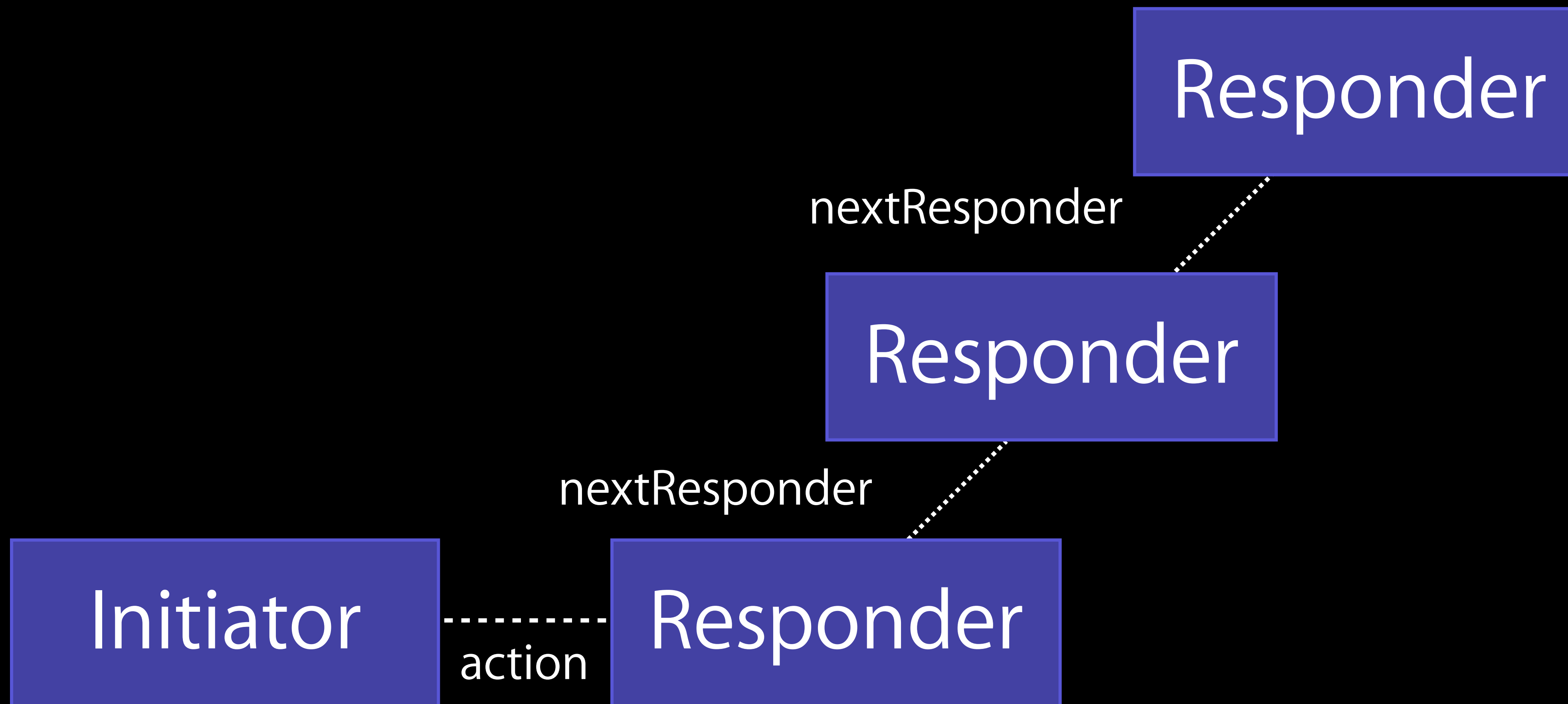
# Responder Chain



# Responder Chain

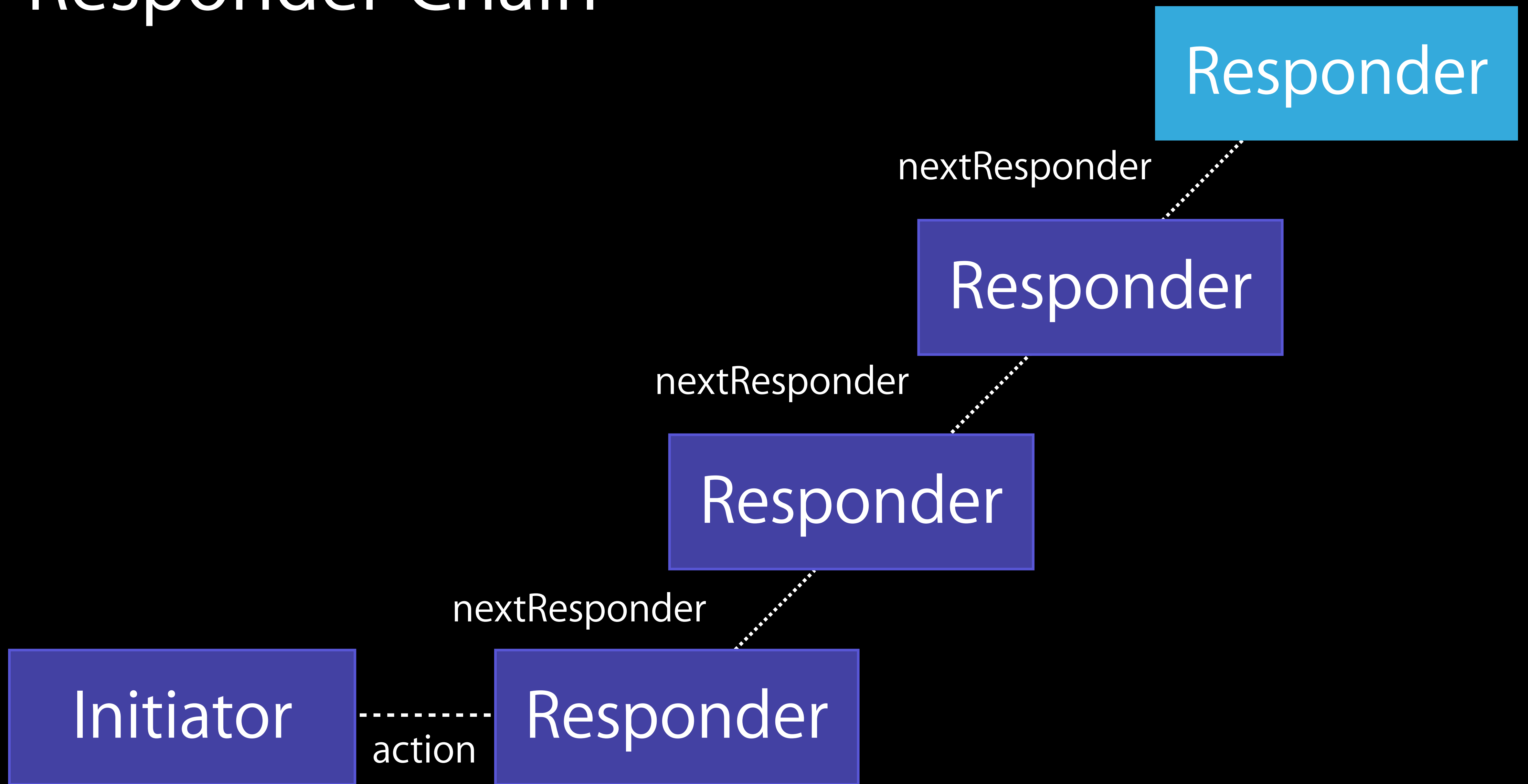


# Responder Chain



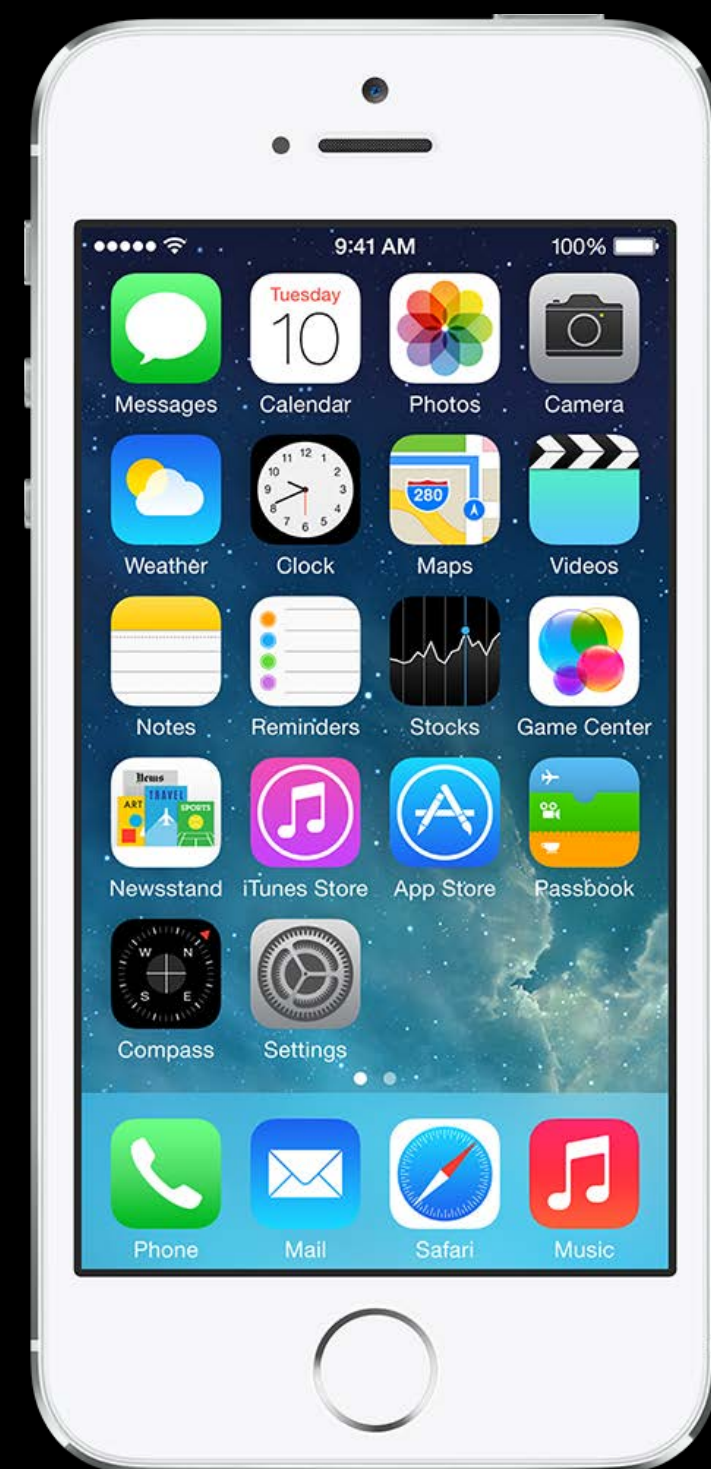


# Responder Chain



# Responder Chain

## Motion events



# Responder Chain

Motion events



# Responder Chain

Motion events



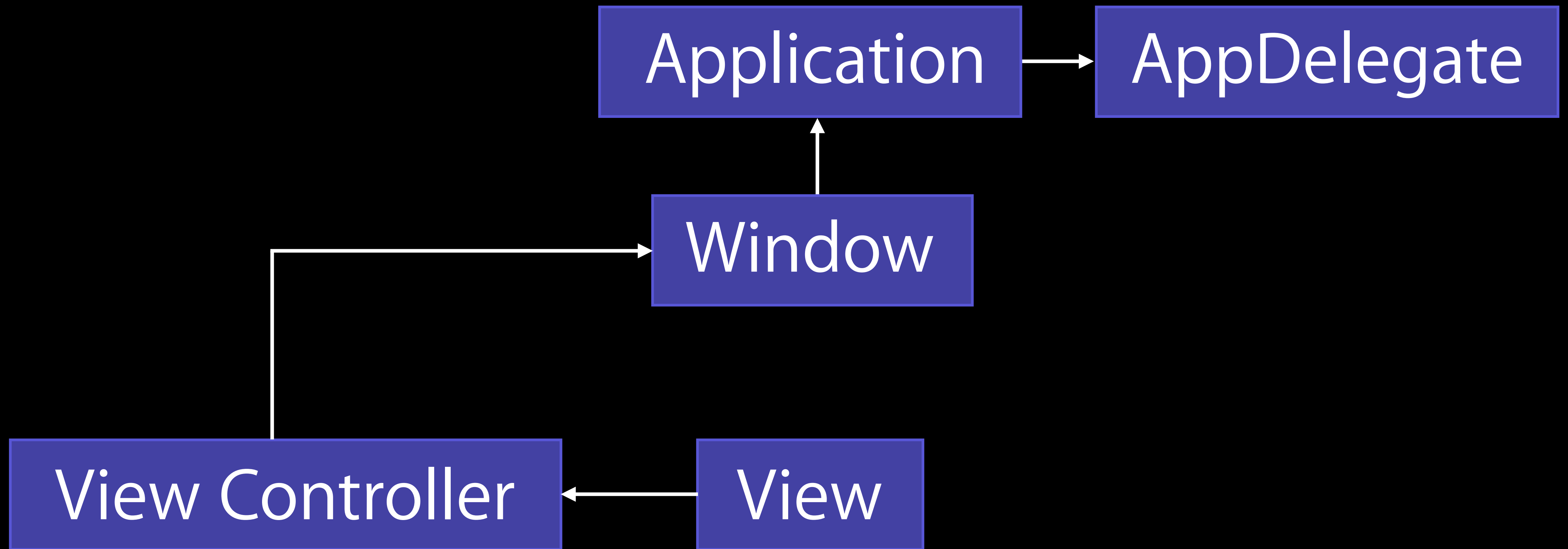
motionBegan:withEvent:  
motionEnded:withEvent:  
motionCancelled:withEvent:



nextResponder

# Responder Chain

All applications



# Responder Chain

Composite

# Composite

View hierarchy

Manipulate a group of objects  
as a single object



# Composite

View hierarchy



View

# Composite

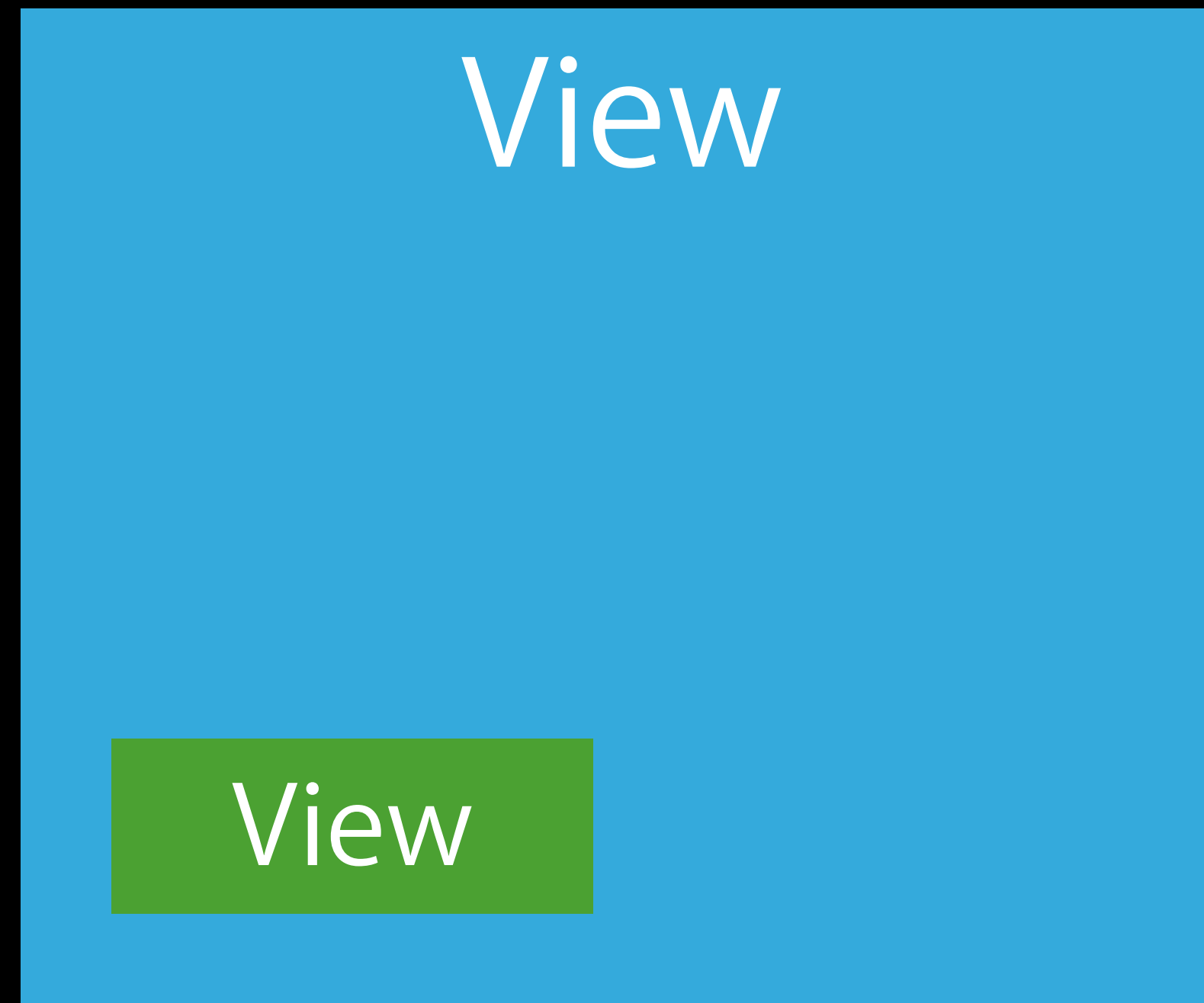
## View hierarchy

View

View

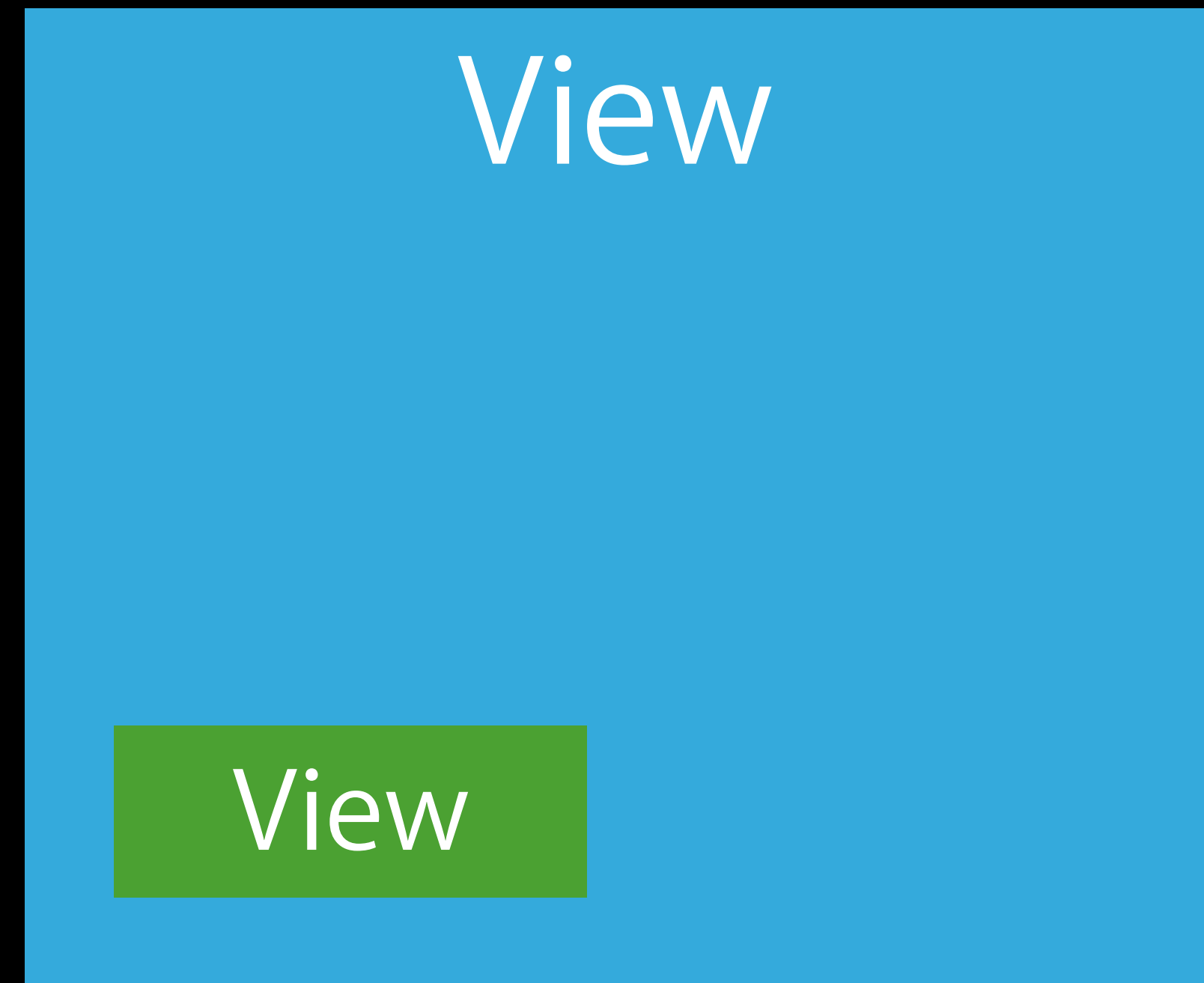
# Composite

## View hierarchy



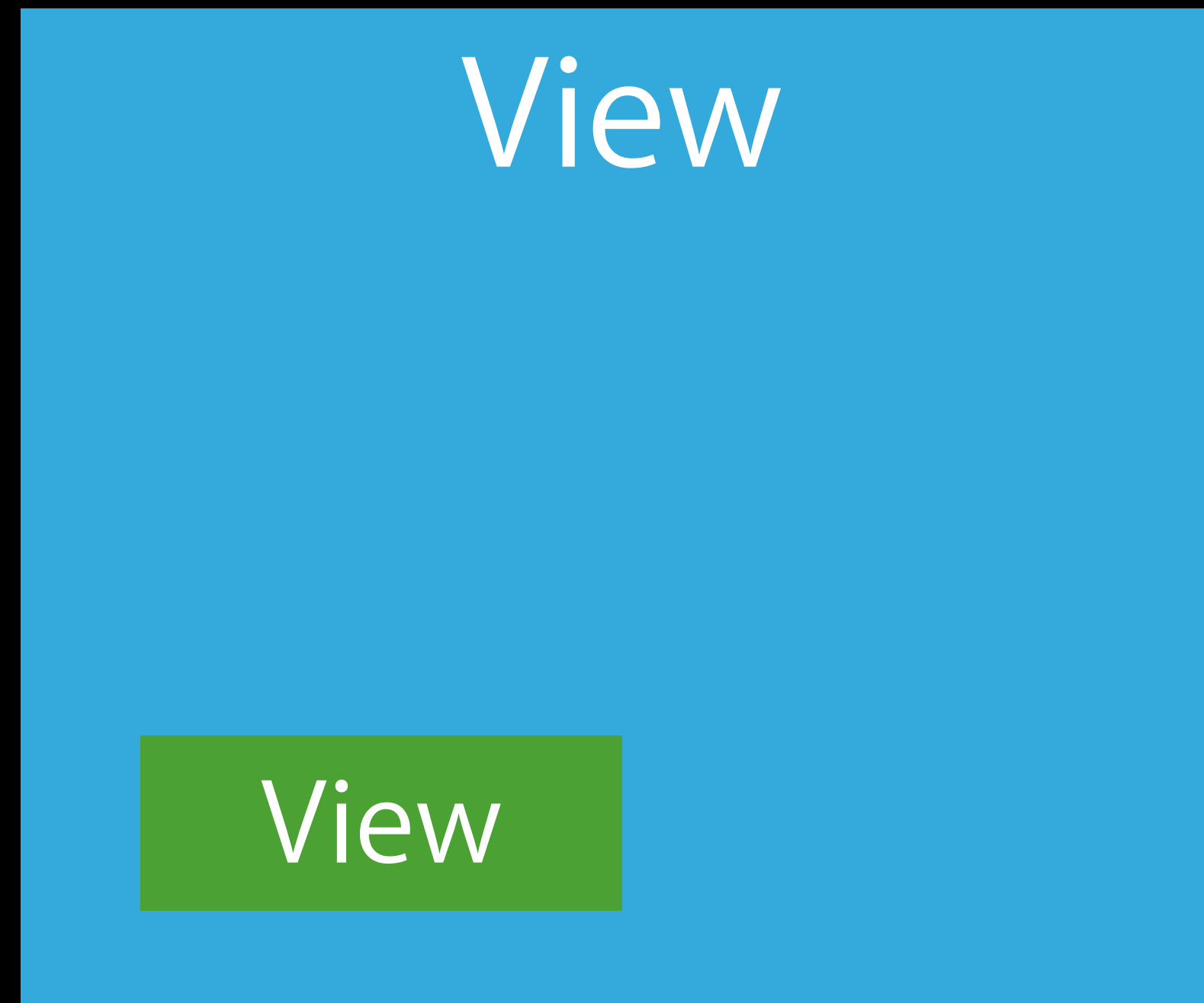
# Composite

## View hierarchy



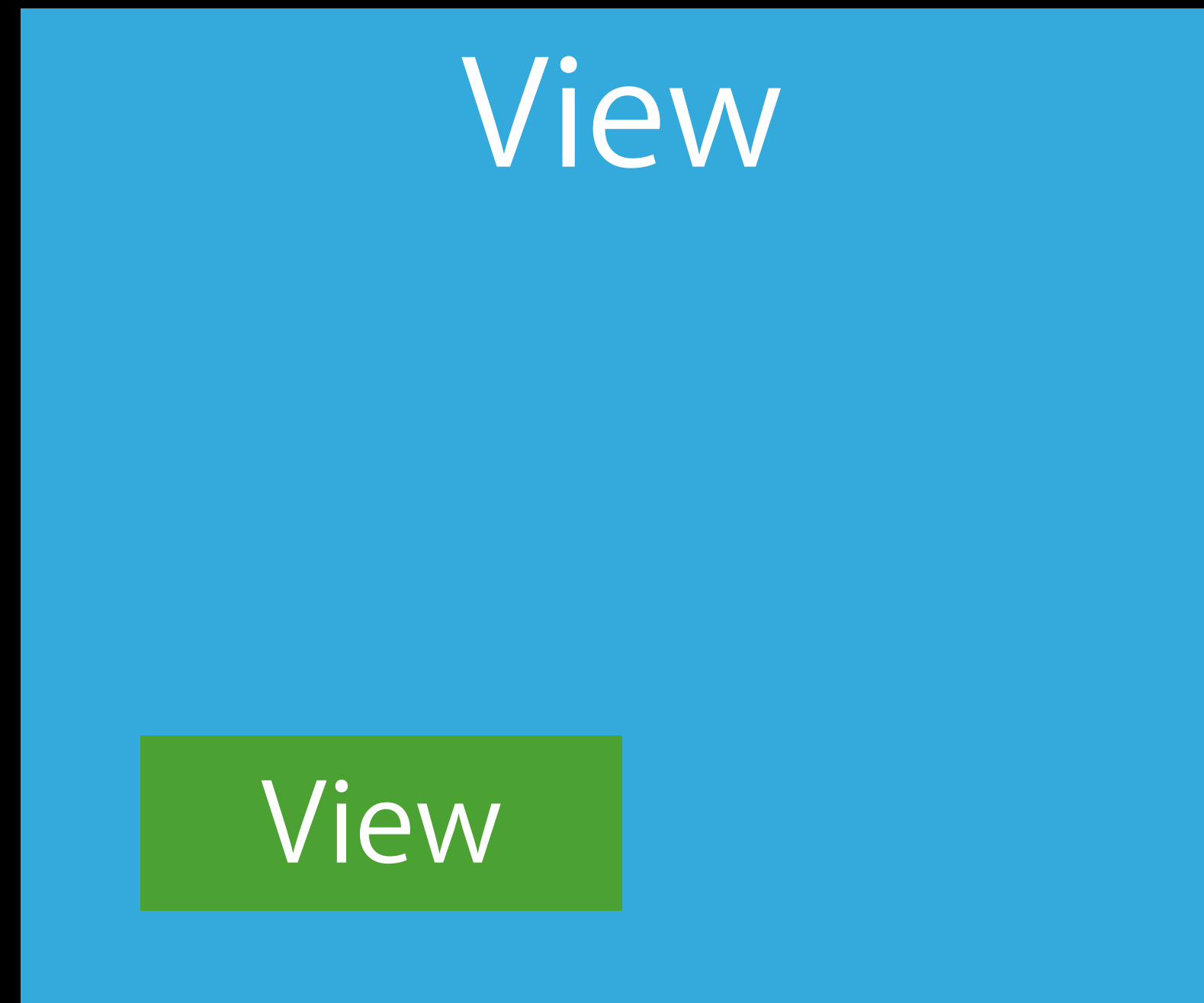
# Composite

## View hierarchy



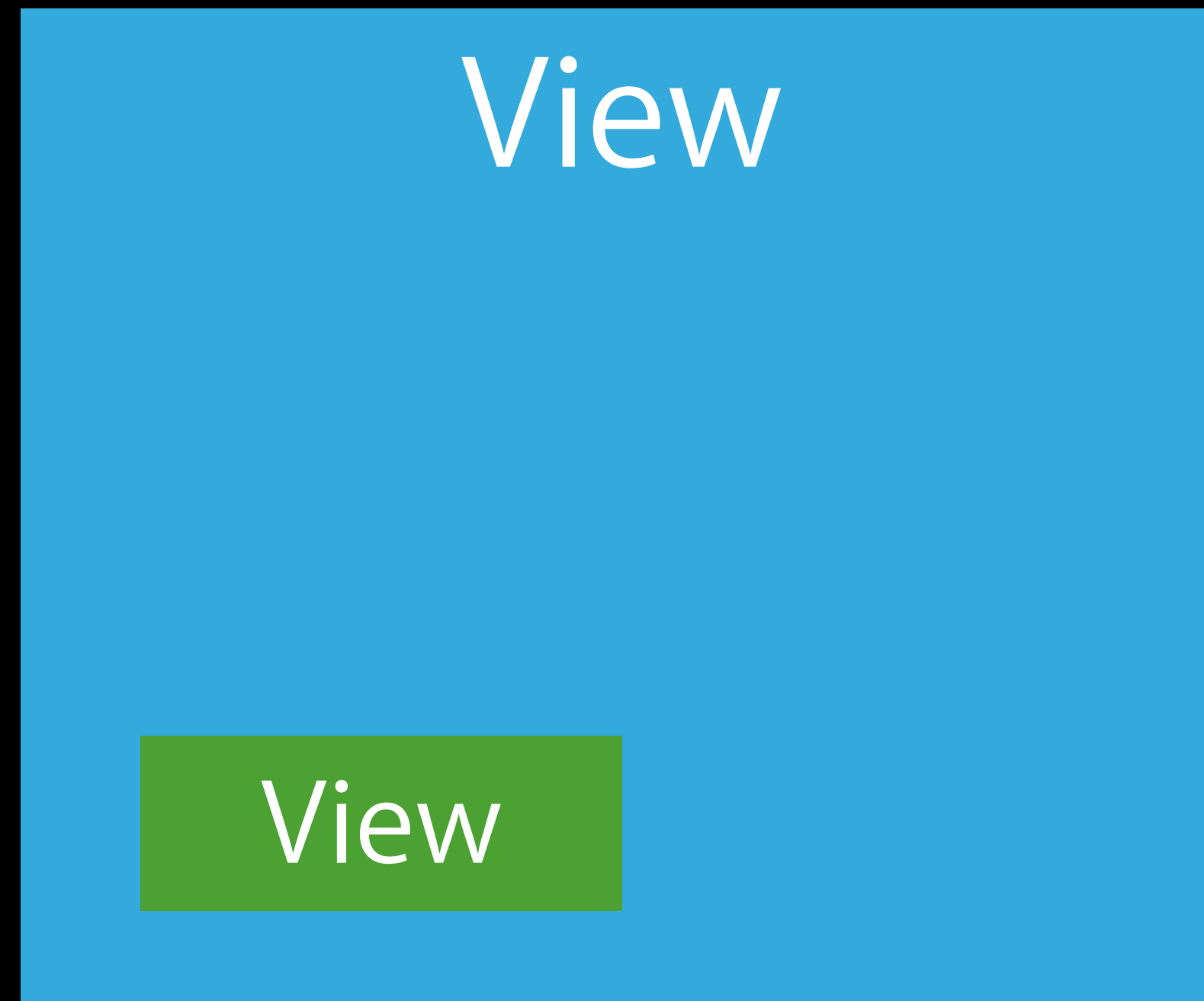
# Composite

## View hierarchy



# Composite

Responder chain



# Composite

UIDynamicBehavior



Dynamic  
Behavior

Dynamic  
Behavior



Composite

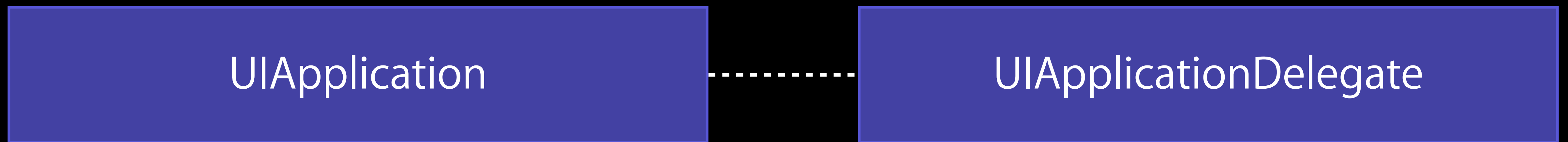
Delegation

# Delegation

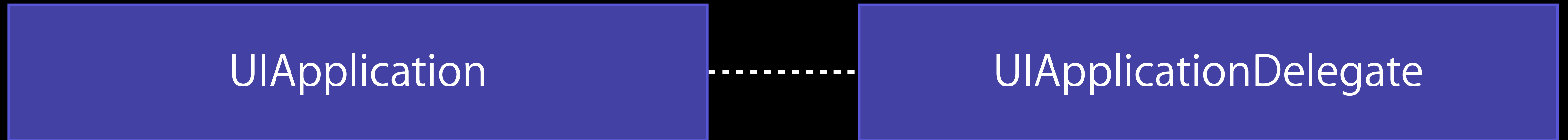
Customize behavior without  
subclassing

# Delegation

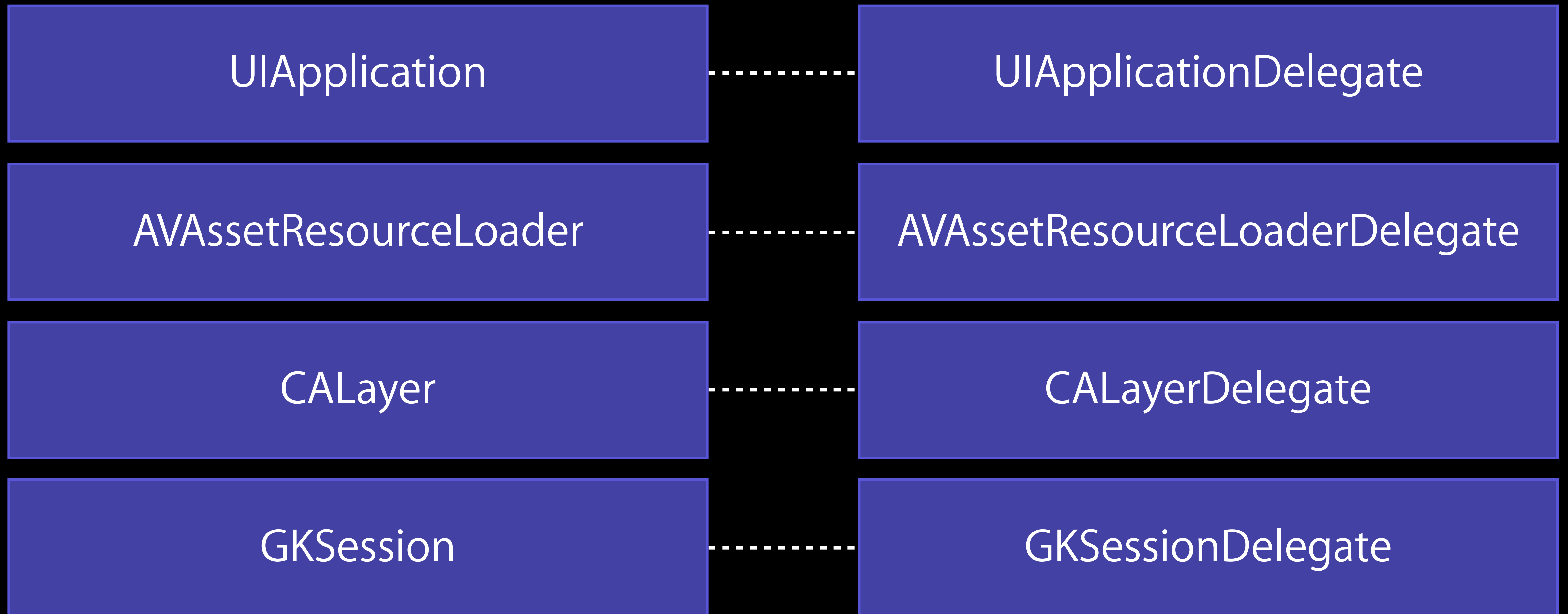
UIApplicationDelegate



# Delegation



# Delegation



Delegation

Data Source

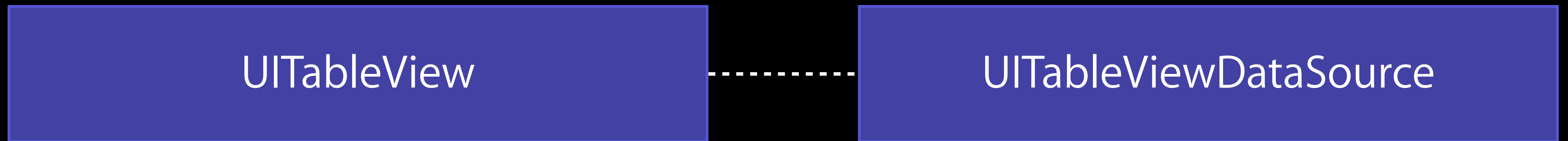


# Data Source

Customize data retrieval without  
subclassing

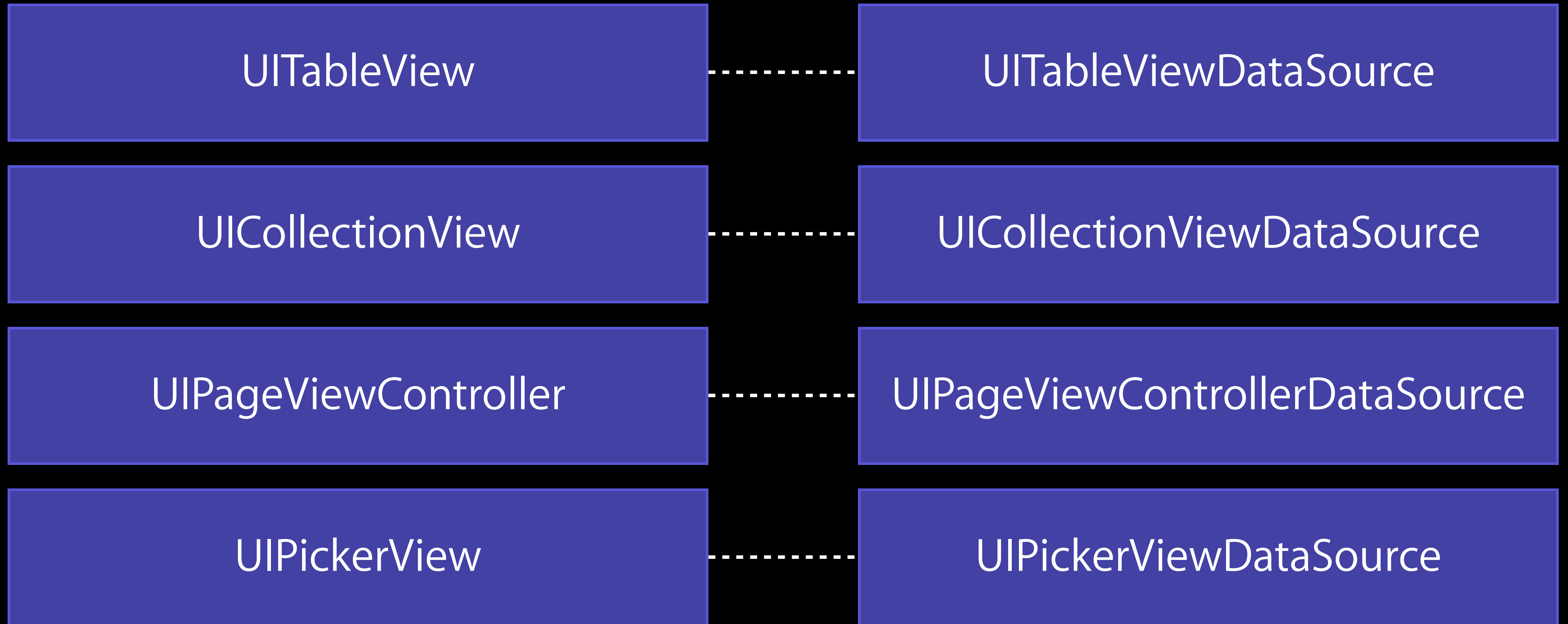
# Data Source

Table View



# Data Source

In UIKit



# Data Source

Customize data retrieval without  
subclassing

# Data Source

Customize behavior without  
subclassing

Data Source

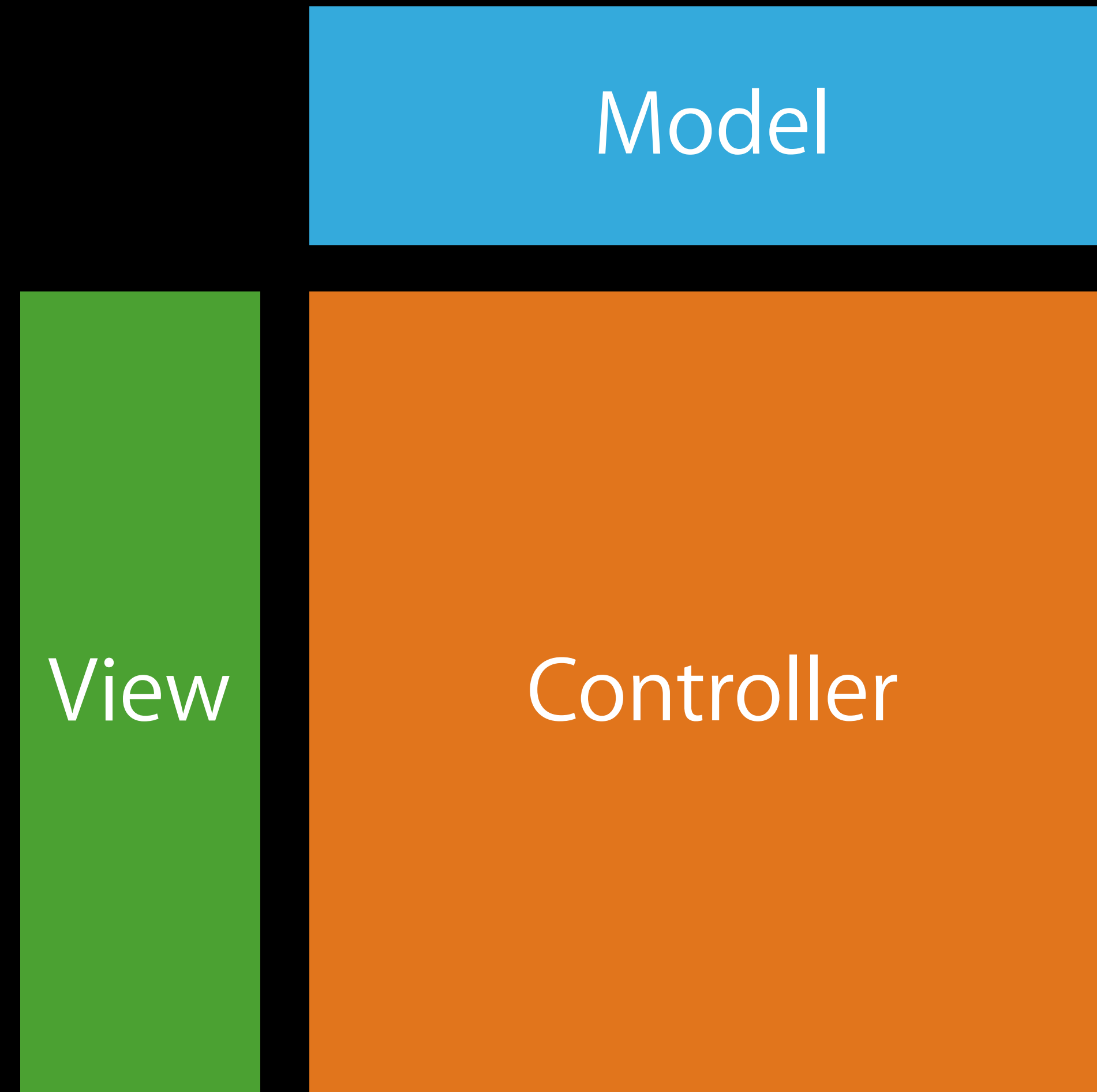
Model-View-Controller

# Model-View-Controller

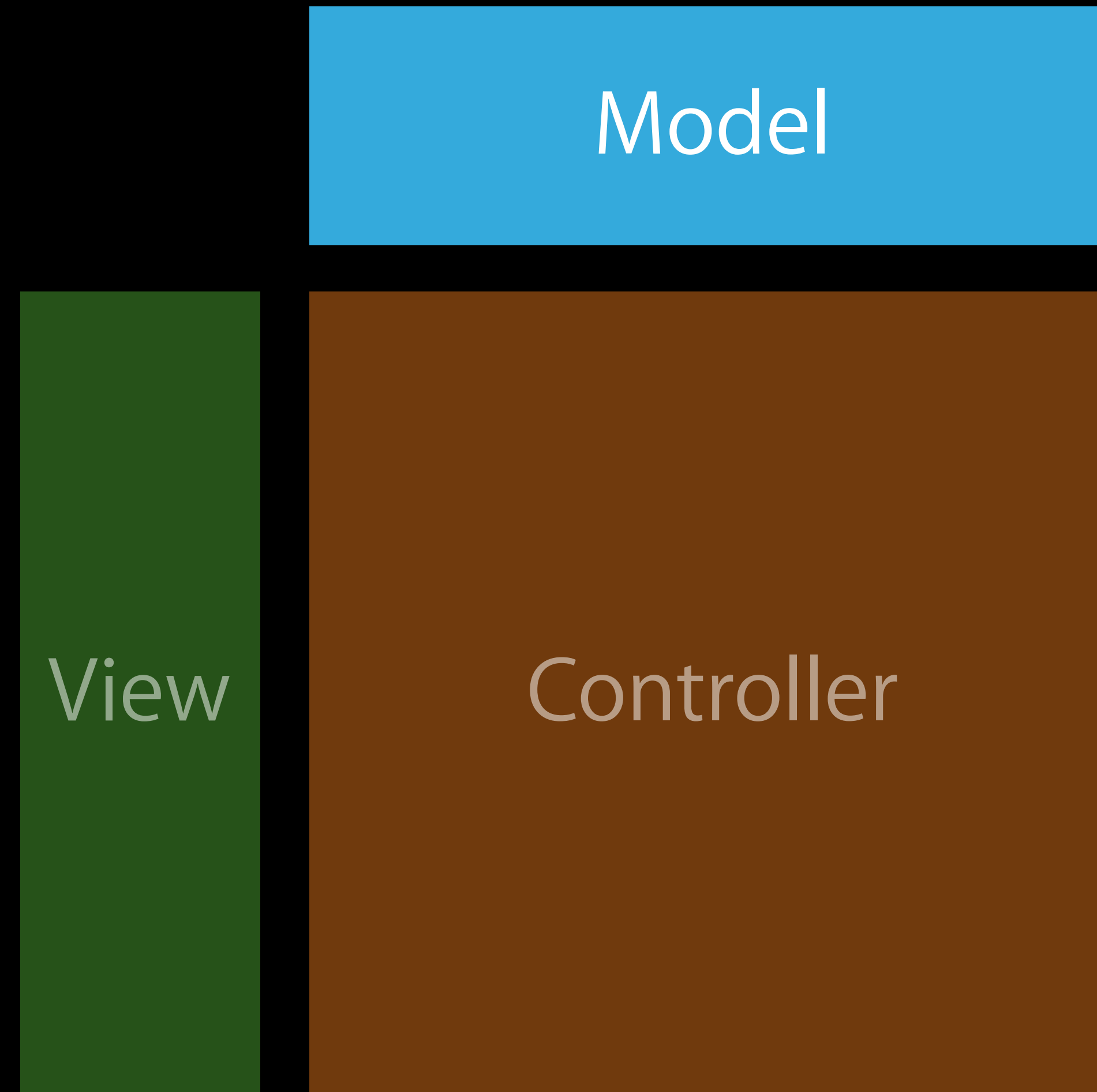
Provide organizational structure  
to focus responsibilities



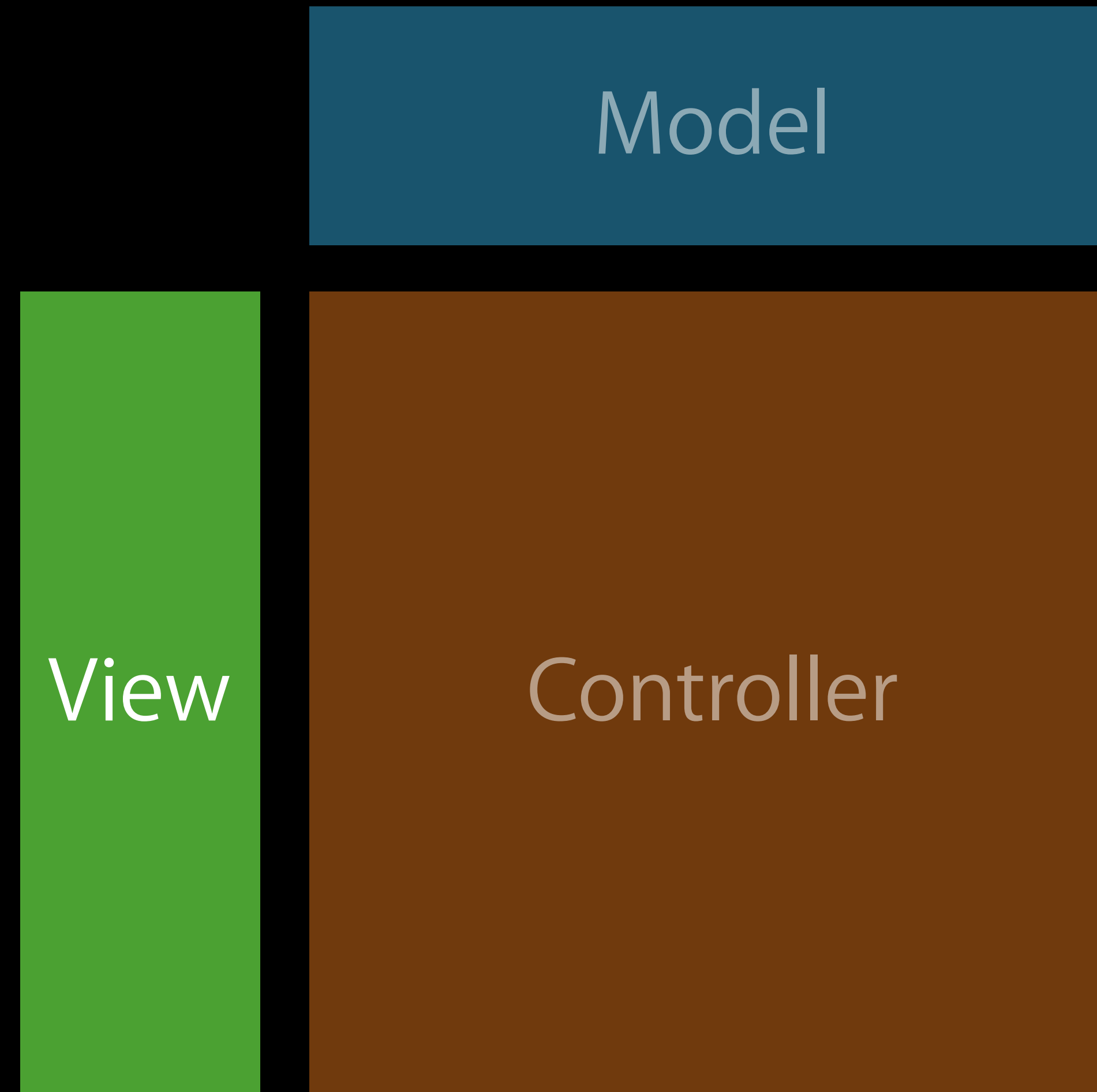
# Model-View-Controller



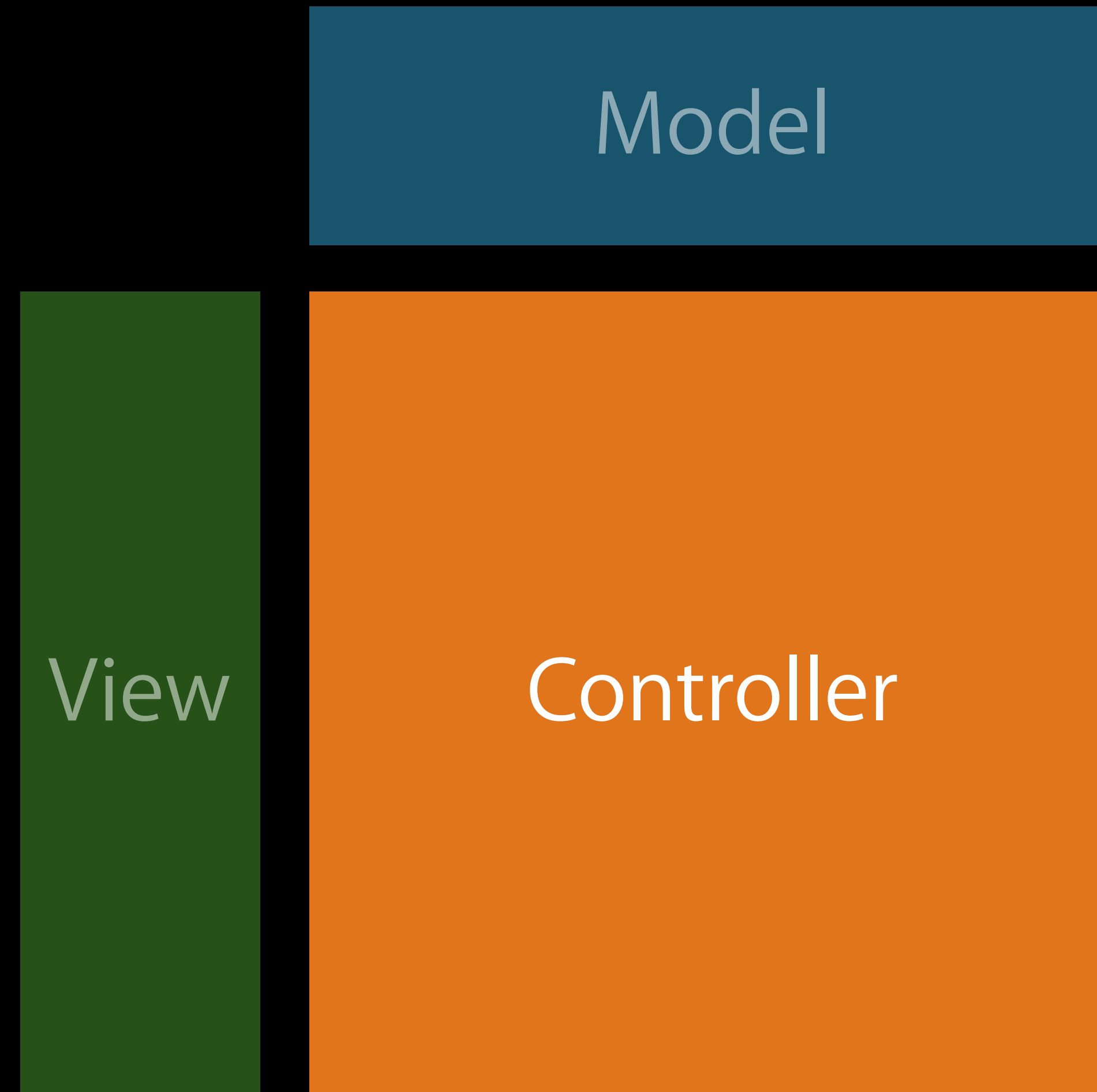
# Model-View-Controller



# Model-View-Controller



# Model-View-Controller



# Model-View-Controller

# Applying Patterns

Your code—made better

Sample App

# Application Definition Statement

Allow people to share simple, short updates about what is happening in their lives



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Allow people to share simple, short updates about what is happening in their lives

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Allow people to share simple, short updates about what is **happening** in their lives

Qwinkle

# Qwinkle

Networked

Lists of data

Good performance

Add an entry

Add photos

Mark items

Edit posts

# Application Definition Statement

Allow people to share simple, short updates about what is happening in their lives

# Qwinkle

Networked

Lists of data

Good performance

Add an entry

Add photos

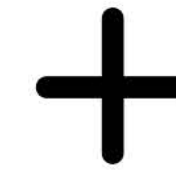
Mark items

Edit posts

# Building the App



# Qwinks



Porchetta t-bone meatloaf  
bresaola, ball tip short loin pig  
jerky brisket tongue bacon shank  
salami. Sirloin landjaeger pastrami  
shoulder beef shank, corned beef  
tail strip steak.



Distillery non post-ironic occupy  
photo booth. Tousled church-key  
laborum, four loko pork belly  
Vinegar twee chia jean shorts  
commodo.



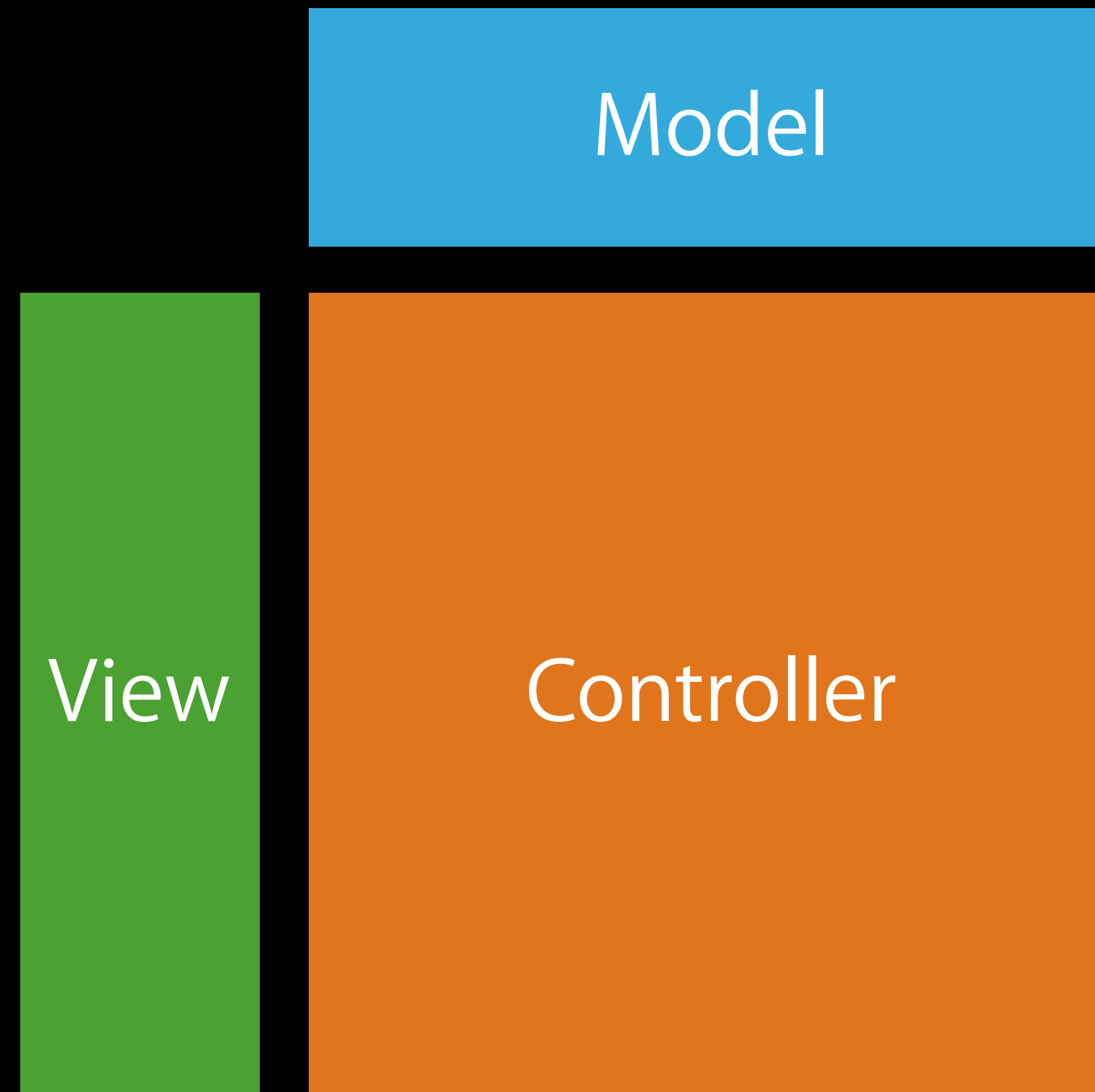
Turducken cow drumstick, turkey  
flank tenderloin short ribs venison  
leberkas. T-bone hamburger  
fatback drumstick bacon salami  
pork biltong leberkas short loin  
shankle doner tri-tip



Tattooed keytar veniam, try-hard  
vegan assumenda quinoa  
chillwave. Viral sed, accusamus 90's  
adipisicing gentrify iPhone ethical  
flexitarian.

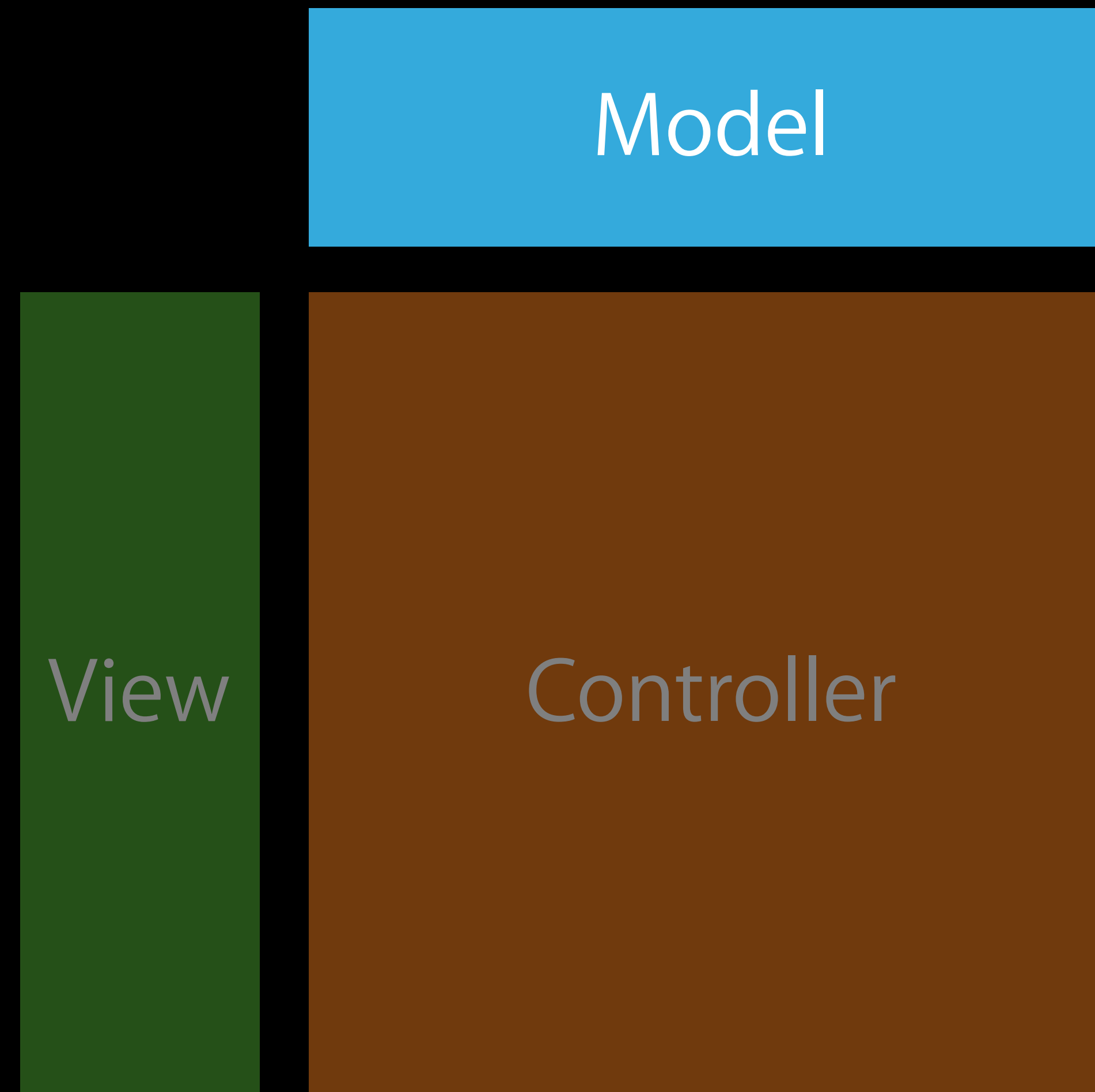
# Model-View-Controller

A guide to conceptualize our app



# Model-View-Controller

A guide to conceptualize our app



# Model

Application data

A user can specify an avatar

# Model

Application data

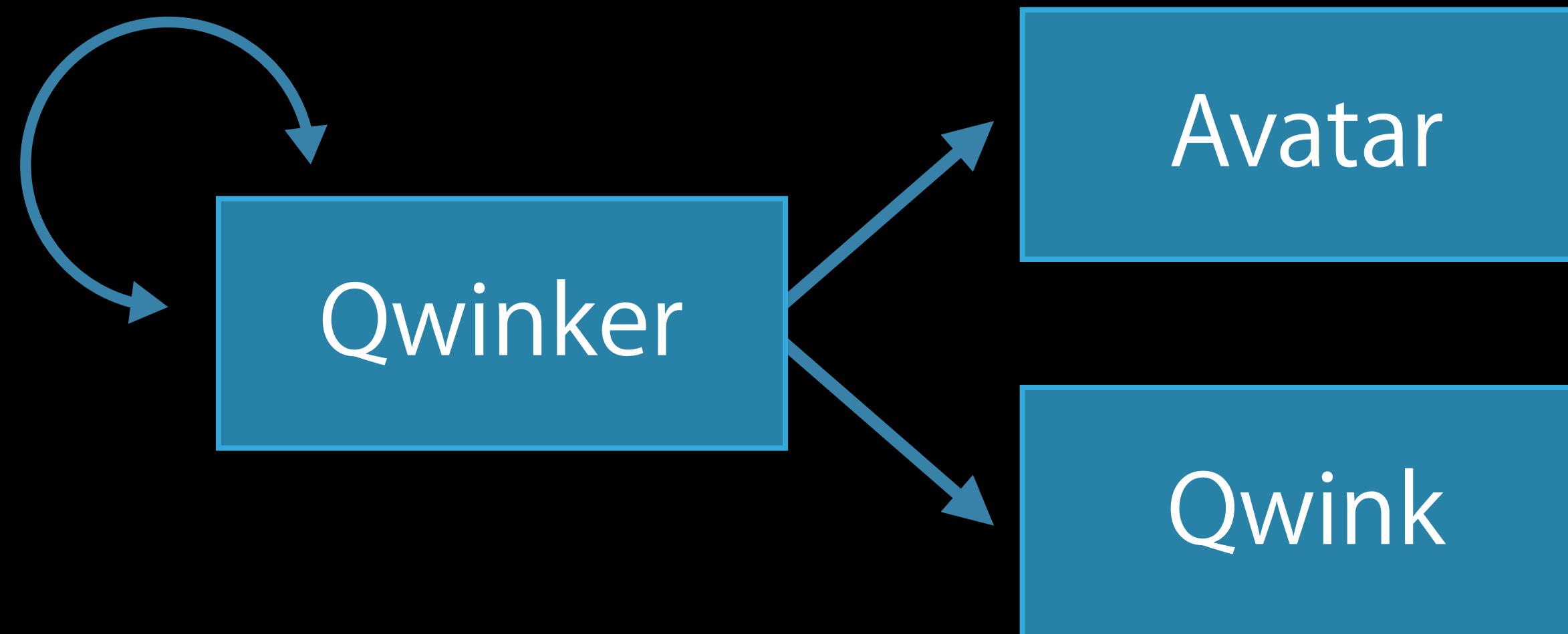
A user can specify an avatar

A user can add an entry

A user can follow a friend

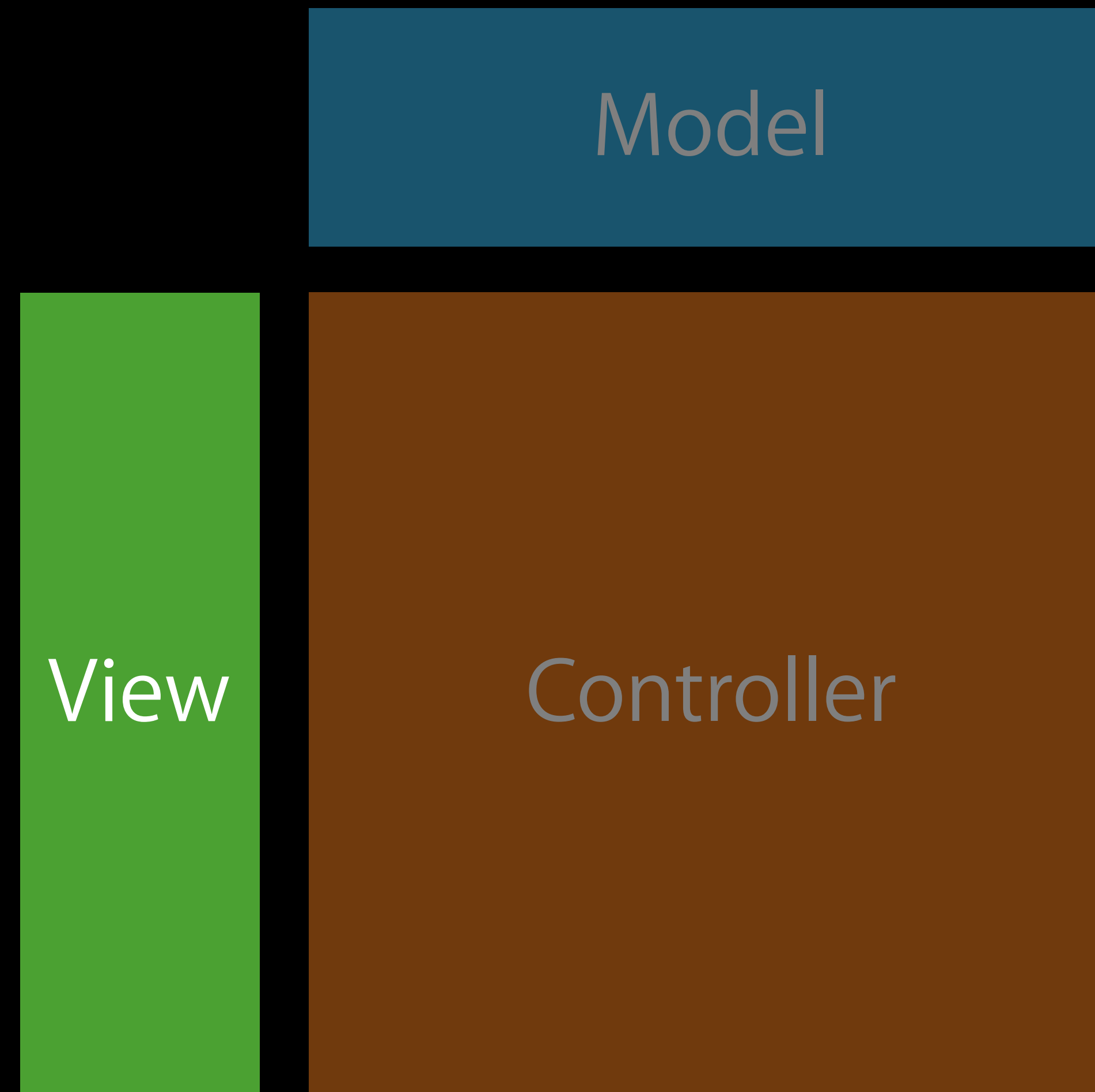
# Model

Application data



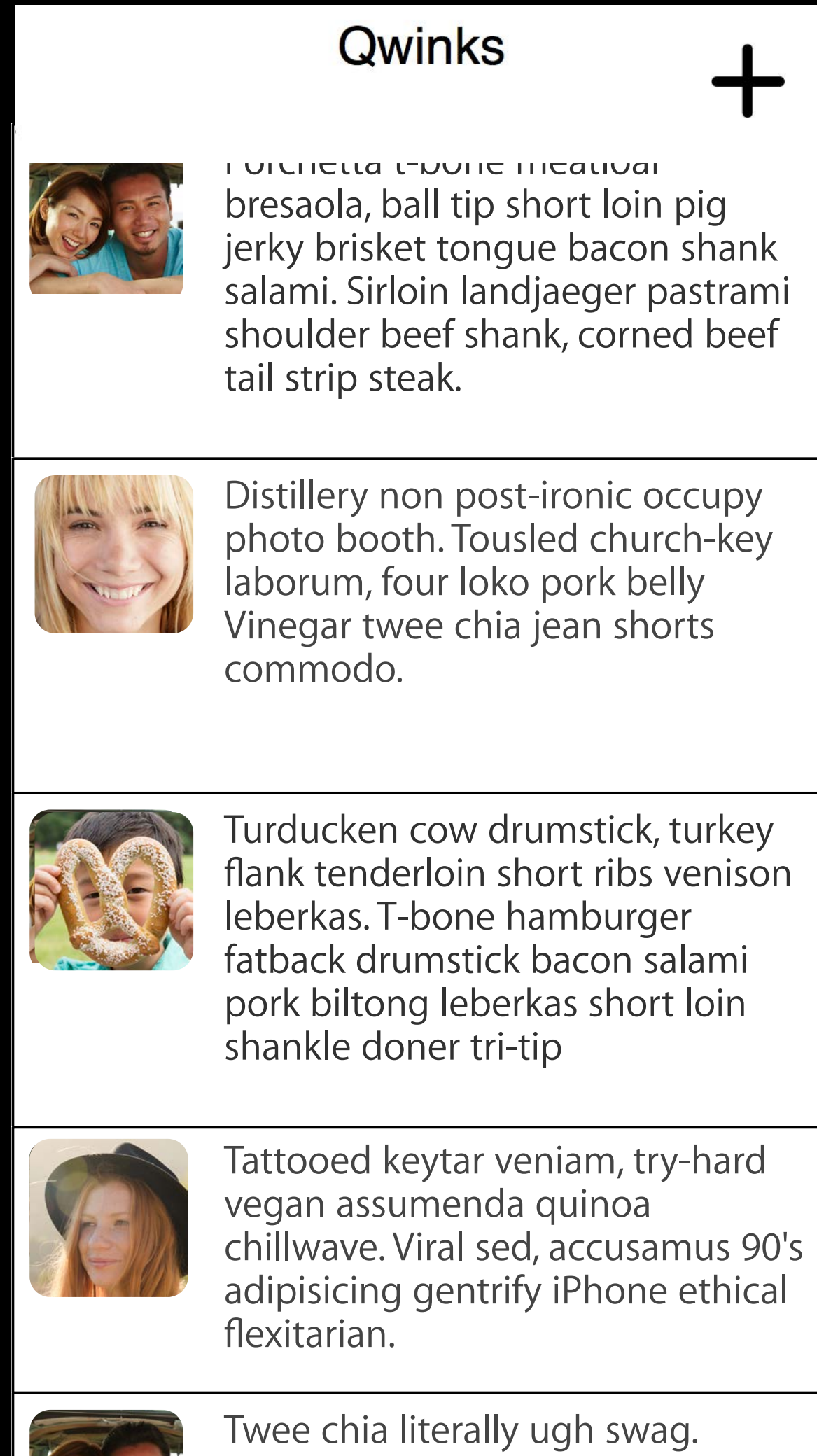
# Model-View-Controller

A guide to conceptualize our app



# Composite

## Scrolling



View

NavBar

Button

TableView

TableViewCell

ImageView

TextView

TableViewCell

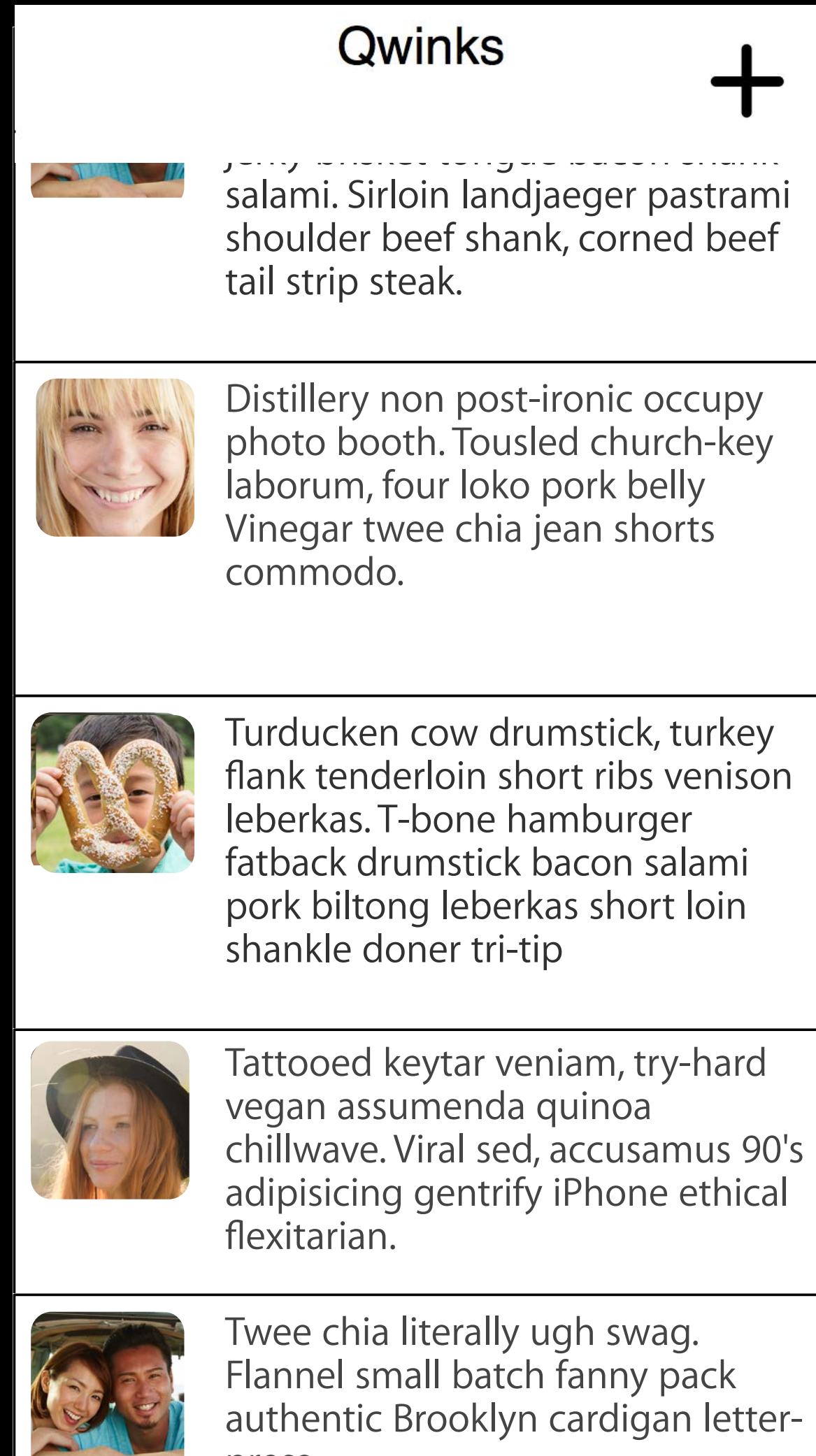
ImageView

TextView



# Composite

## Scrolling



View

NavBar

Button

TableView

TableViewCell

ImageView

TextView

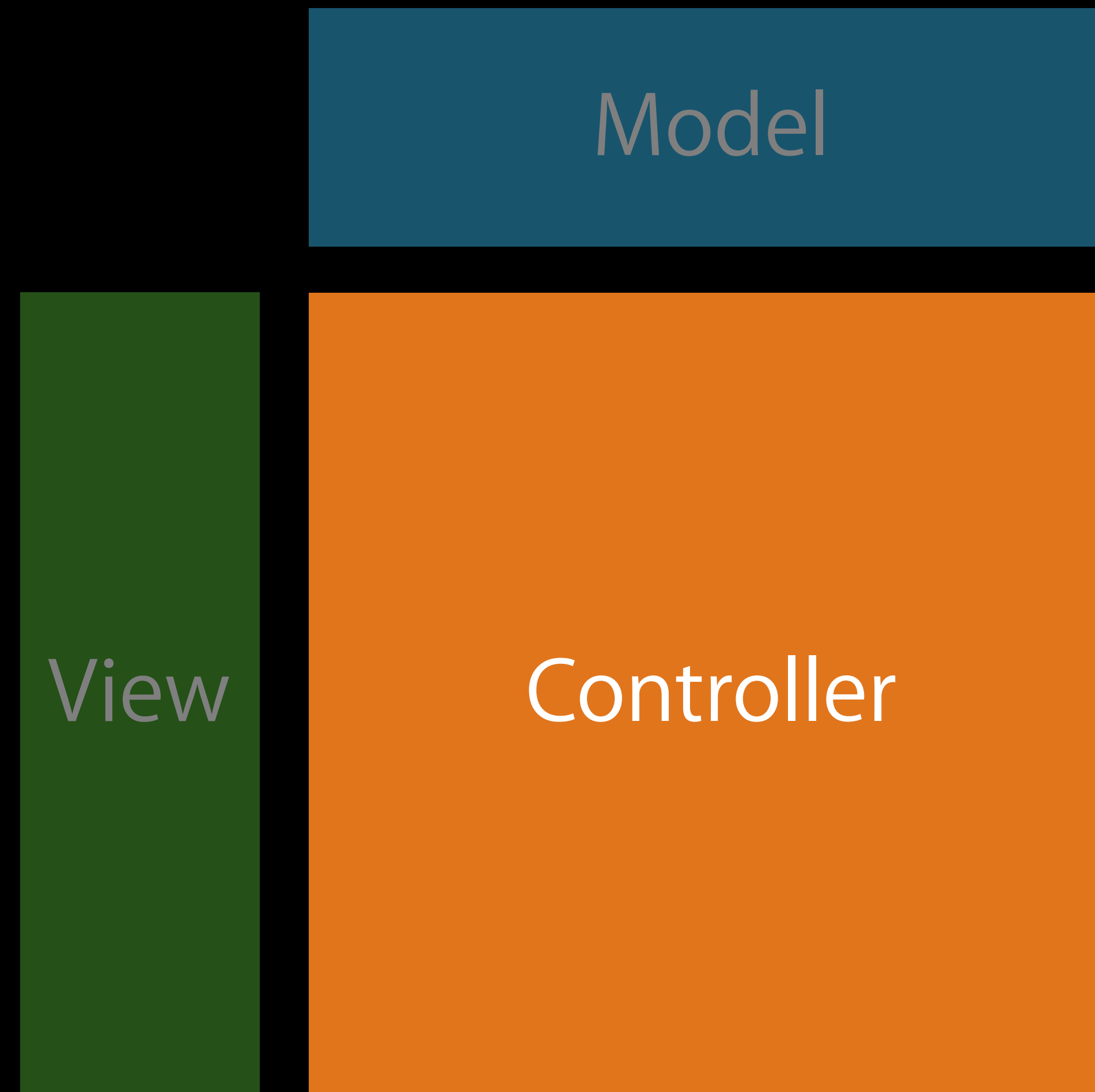
TableViewCell

ImageView

TextView





# Model-View-Controller

A guide to conceptualize our app







# Qwinkle

## Data source

Qwinks	+
	Forenetta t-bone meatloaf bresaola, ball tip short loin pig jerky brisket tongue bacon shank salami. Sirloin landjaeger pastrami shoulder beef shank, corned beef tail strip steak.
	Distillery non post-ironic occupy photo booth. Tousled church-key laborum, four loko pork belly Vinegar twee chia jean shorts commodo.
	Turducken cow drumstick, turkey flank tenderloin short ribs venison leberkas. T-bone hamburger fatback drumstick bacon salami pork biltong leberkas short loin shankle doner tri-tip
	Tattooed keytar veniam, try-hard vegan assumenda quinoa chillwave. Viral sed, accusamus 90's adipisicing gentrify iPhone ethical flexitarian.

# Qwinkle





## Data source

Qwinks		+
	Forenetta t-bone meatloaf bresaola, ball tip short loin pig jerky brisket tongue bacon shank salami. Sirloin landjaeger pastrami shoulder beef shank, corned beef tail strip steak.	
	Distillery non post-ironic occupy photo booth. Tousled church-key laborum, four loko pork belly Vinegar twee chia jean shorts commodo.	
	Turducken cow drumstick, turkey flank tenderloin short ribs venison leberkas. T-bone hamburger fatback drumstick bacon salami pork biltong leberkas short loin shankle doner tri-tip	
	Tattooed keytar veniam, try-hard vegan assumenda quinoa chillwave. Viral sed, accusamus 90's adipisicing gentrify iPhone ethical flexitarian.	

UITableView

# Qwinkle

## Data source





Qwinks		+
	Forenetta t-bone meatloaf bresaola, ball tip short loin pig jerky brisket tongue bacon shank salami. Sirloin landjaeger pastrami shoulder beef shank, corned beef tail strip steak.	
	Distillery non post-ironic occupy photo booth. Tousled church-key laborum, four loko pork belly Vinegar twee chia jean shorts commodo.	
	Turducken cow drumstick, turkey flank tenderloin short ribs venison leberkas. T-bone hamburger fatback drumstick bacon salami pork biltong leberkas short loin shankle doner tri-tip	
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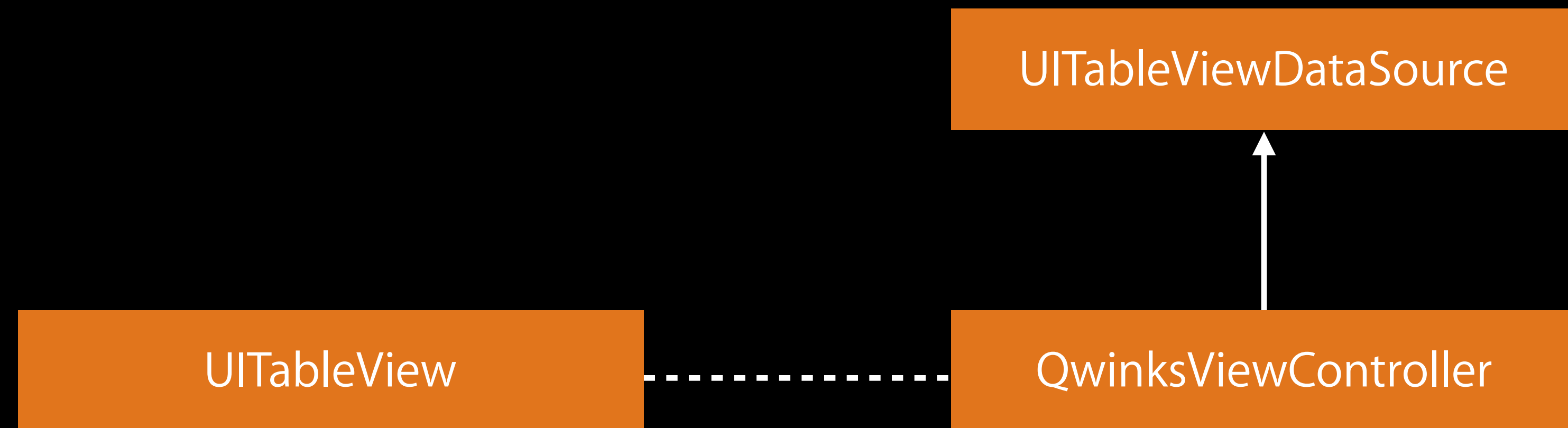
UITableView

QwinksViewController

# Qwinkle

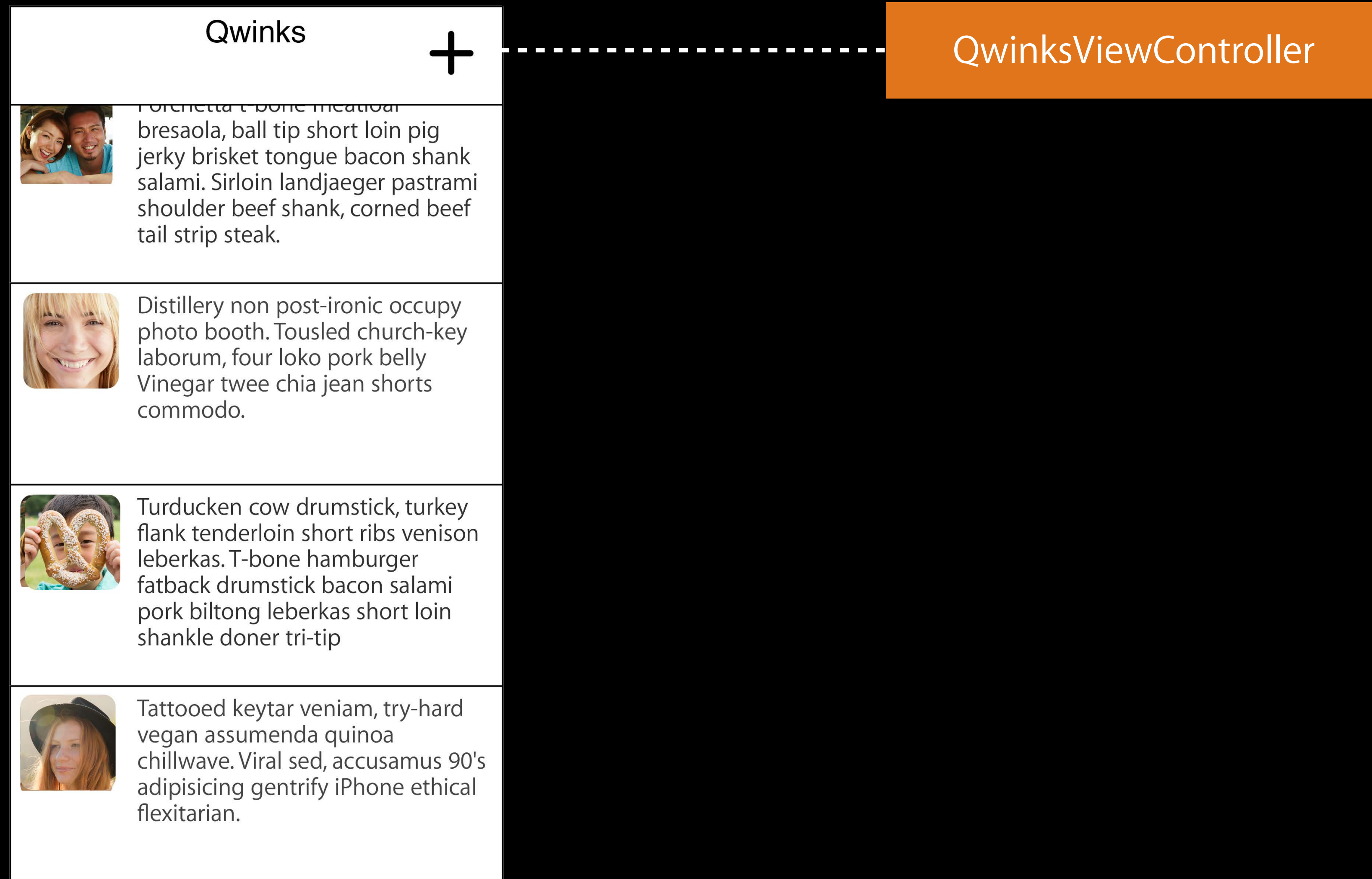
## Data source

Qwinks		+
	Forenetta t-bone meatloaf bresaola, ball tip short loin pig jerky brisket tongue bacon shank salami. Sirloin landjaeger pastrami shoulder beef shank, corned beef tail strip steak.	
	Distillery non post-ironic occupy photo booth. Tousled church-key laborum, four loko pork belly Vinegar twee chia jean shorts commodo.	
	Turducken cow drumstick, turkey flank tenderloin short ribs venison leberkas. T-bone hamburger fatback drumstick bacon salami pork biltong leberkas short loin shankle doner tri-tip	
	Tattooed keytar veniam, try-hard vegan assumenda quinoa chillwave. Viral sed, accusamus 90's adipisicing gentrify iPhone ethical flexitarian.	



# Qwinkle

## Target/Action



# Model-View-Controller

## Networking




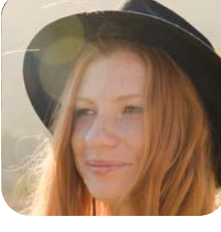

Qwinks		+
	Porchetta tripe meatloaf bresaola, ball tip short loin pig jerky brisket tongue bacon shank salami. Sirloin landjaeger pastrami shoulder beef shank, corned beef tail strip steak.	
	Distillery non post-ironic occupy photo booth. Tousled church-key laborum, four loko pork belly Vinegar twee chia jean shorts commodo.	
	Turducken cow drumstick, turkey flank tenderloin short ribs venison leberkas. T-bone hamburger fatback drumstick bacon salami pork biltong leberkas short loin shankle doner tri-tip	
	Tattooed keytar veniam, try-hard vegan assumenda quinoa chillwave. Viral sed, accusamus 90's adipisicing gentrify iPhone ethical flexitarian.	
	Twee chia literally ugh swag.	


Table View Controller


NSURLSession





# Model-View-Controller


## Qwinks +

 Porchetta t-bone meatloaf bresaola, ball tip short loin pig jerky brisket tongue bacon shank salami. Sirloin landjaeger pastrami shoulder beef shank, corned beef tail strip steak.

 Distillery non post-ironic occupy photo booth. Tousled church-key laborum, four loko pork belly Vinegar twee chia jean shorts commodo.

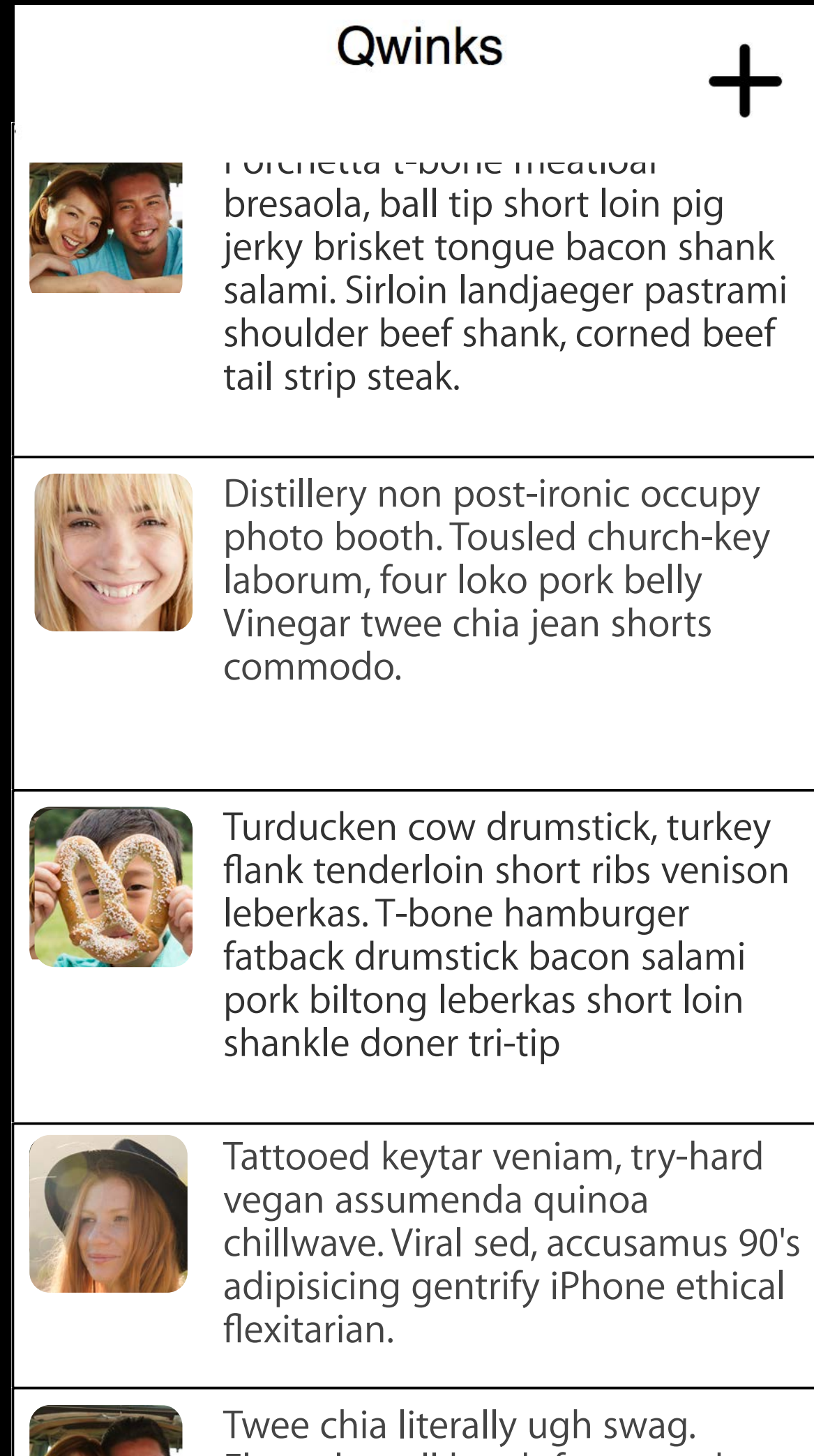
 Turducken cow drumstick, turkey flank tenderloin short ribs venison leberkas. T-bone hamburger fatback drumstick bacon salami pork biltong leberkas short loin shankle doner tri-tip


 Tattooed keytar veniam, try-hard vegan assumenda quinoa chillwave. Viral sed, accusamus 90's adipisicing gentrify iPhone ethical flexitarian.


 Twee chia literally ugh swag.


# Model-View-Controller


## Qwinks +




 Porchetta t-bone meatloaf bresaola, ball tip short loin pig jerky brisket tongue bacon shank salami. Sirloin landjaeger pastrami shoulder beef shank, corned beef tail strip steak.

 Distillery non post-ironic occupy photo booth. Tousled church-key laborum, four loko pork belly Vinegar twee chia jean shorts commodo.


 Turducken cow drumstick, turkey flank tenderloin short ribs venison leberkas. T-bone hamburger fatback drumstick bacon salami pork biltong leberkas short loin shankle doner tri-tip


 Tattooed keytar veniam, try-hard vegan assumenda quinoa chillwave. Viral sed, accusamus 90's adipisicing gentrify iPhone ethical flexitarian.


 Twee chia literally ugh swag.


PublicTimelineViewController


# Model-View-Controller

Qwinks 

 Porchetta t-bone meatloaf bresaola, ball tip short loin pig jerky brisket tongue bacon shank salami. Sirloin landjaeger pastrami shoulder beef shank, corned beef tail strip steak.

 Distillery non post-ironic occupy photo booth. Tousled church-key laborum, four loko pork belly Vinegar twee chia jean shorts commodo.

 Turducken cow drumstick, turkey flank tenderloin short ribs venison leberkas. T-bone hamburger fatback drumstick bacon salami pork biltong leberkas short loin shankle doner tri-tip

 Tattooed keytar veniam, try-hard vegan assumenda quinoa chillwave. Viral sed, accusamus 90's adipisicing gentrify iPhone ethical flexitarian.


 Twee chia literally ugh swag.

Table  
View

PublicTimelineViewController

# Model-View-Controller

**Qwinks** +

Porchetta (bone meal) bresaola, ball tip short loin pig jerky brisket tongue bacon shank salami. Sirloin landjaeger pastrami shoulder beef shank, corned beef tail strip steak.

Distillery non post-ironic occupy photo booth. Tousled church-key laborum, four loko pork belly Vinegar twee chia jean shorts commodo.

Turducken cow drumstick, turkey flank tenderloin short ribs venison leberkas. T-bone hamburger fatback drumstick bacon salami pork biltong leberkas short loin shankle doner tri-tip

Tattooed keytar veniam, try-hard vegan assumenda quinoa chillwave. Viral sed, accusamus 90's adipisicing gentrify iPhone ethical flexitarian.

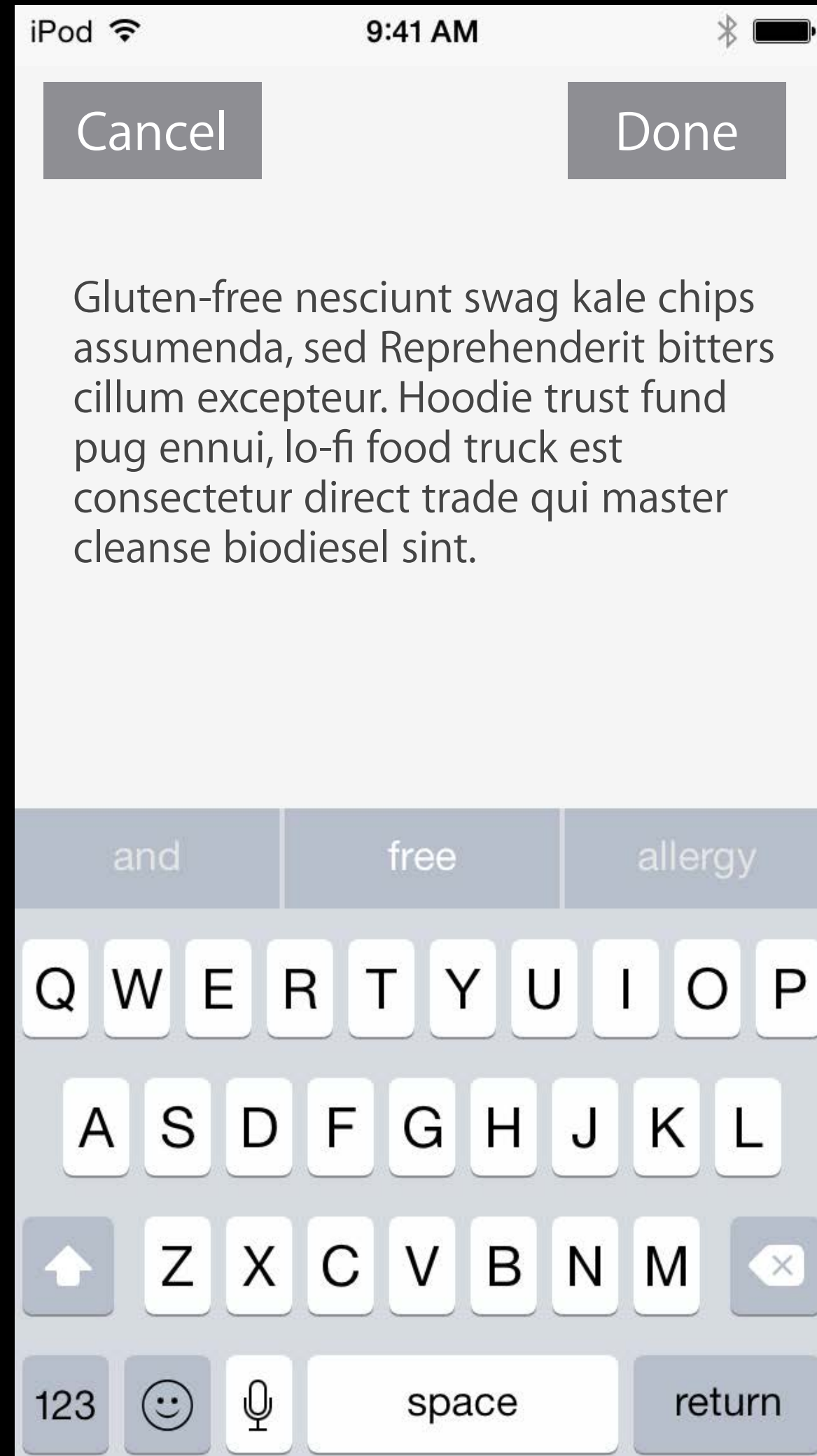
Twee chia literally ugh swag.

Qwinker

Table View

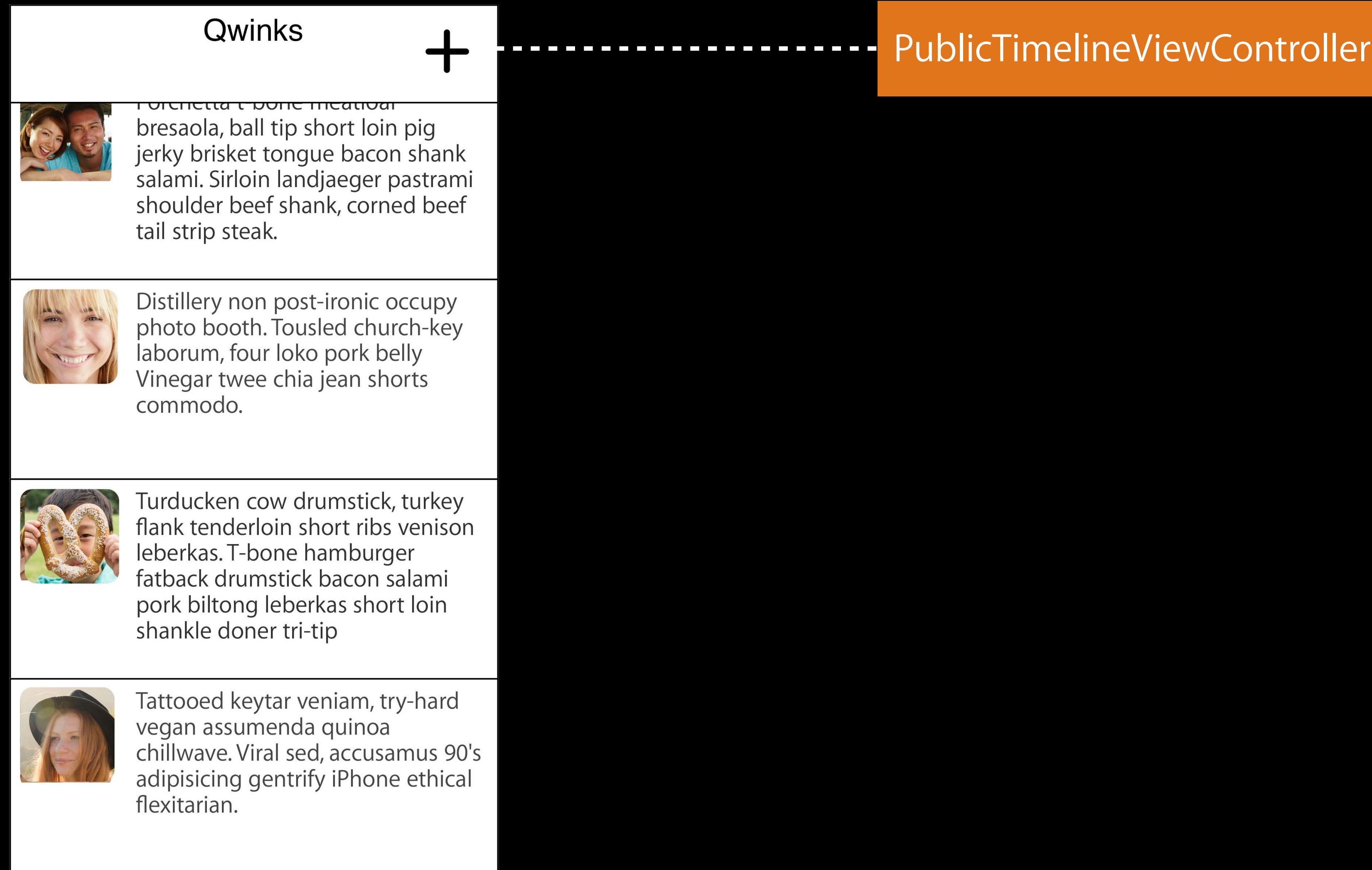
PublicTimelineViewController

# Model-View-Controller



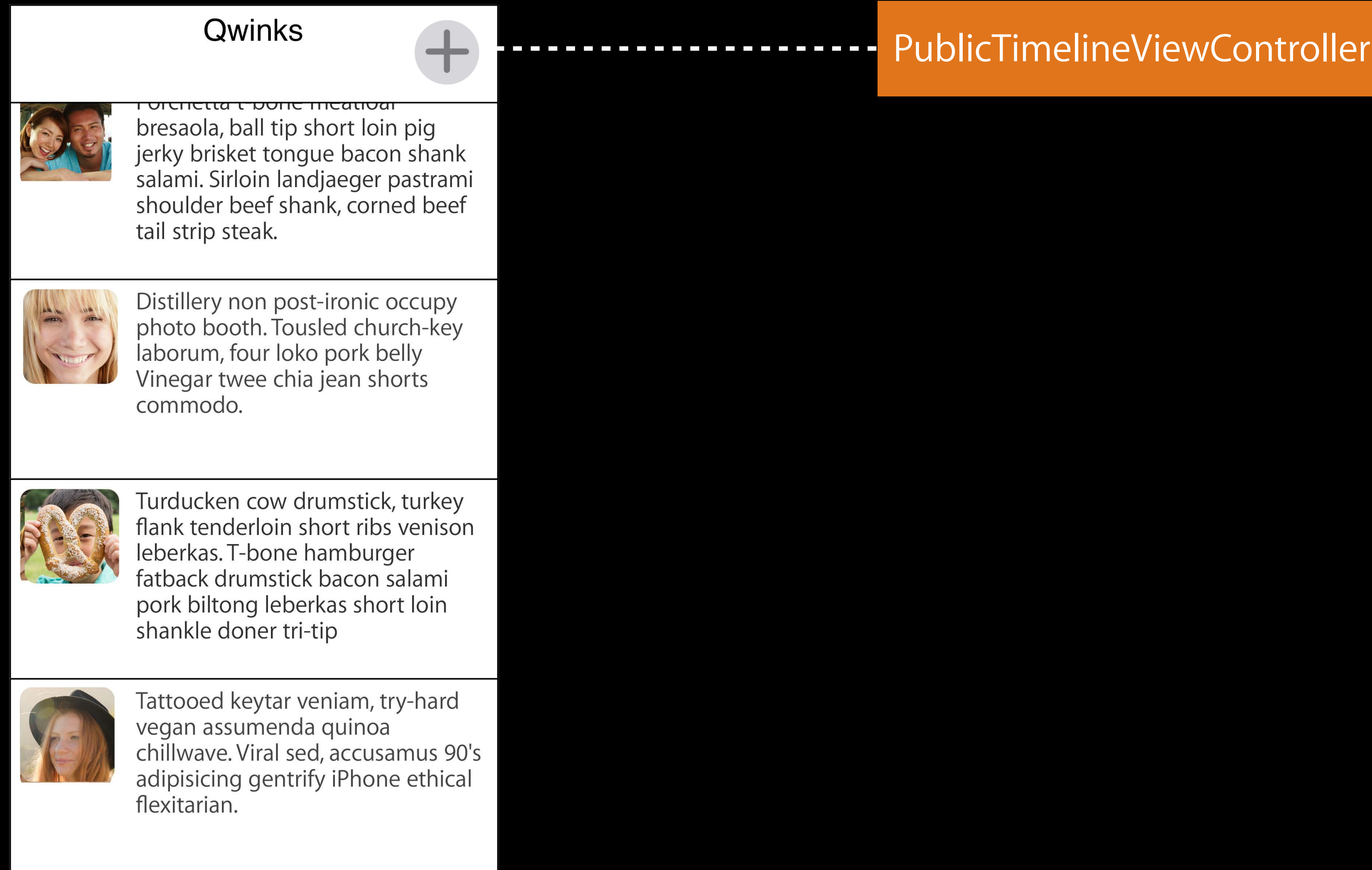
# Qwinkle

## Target/Action



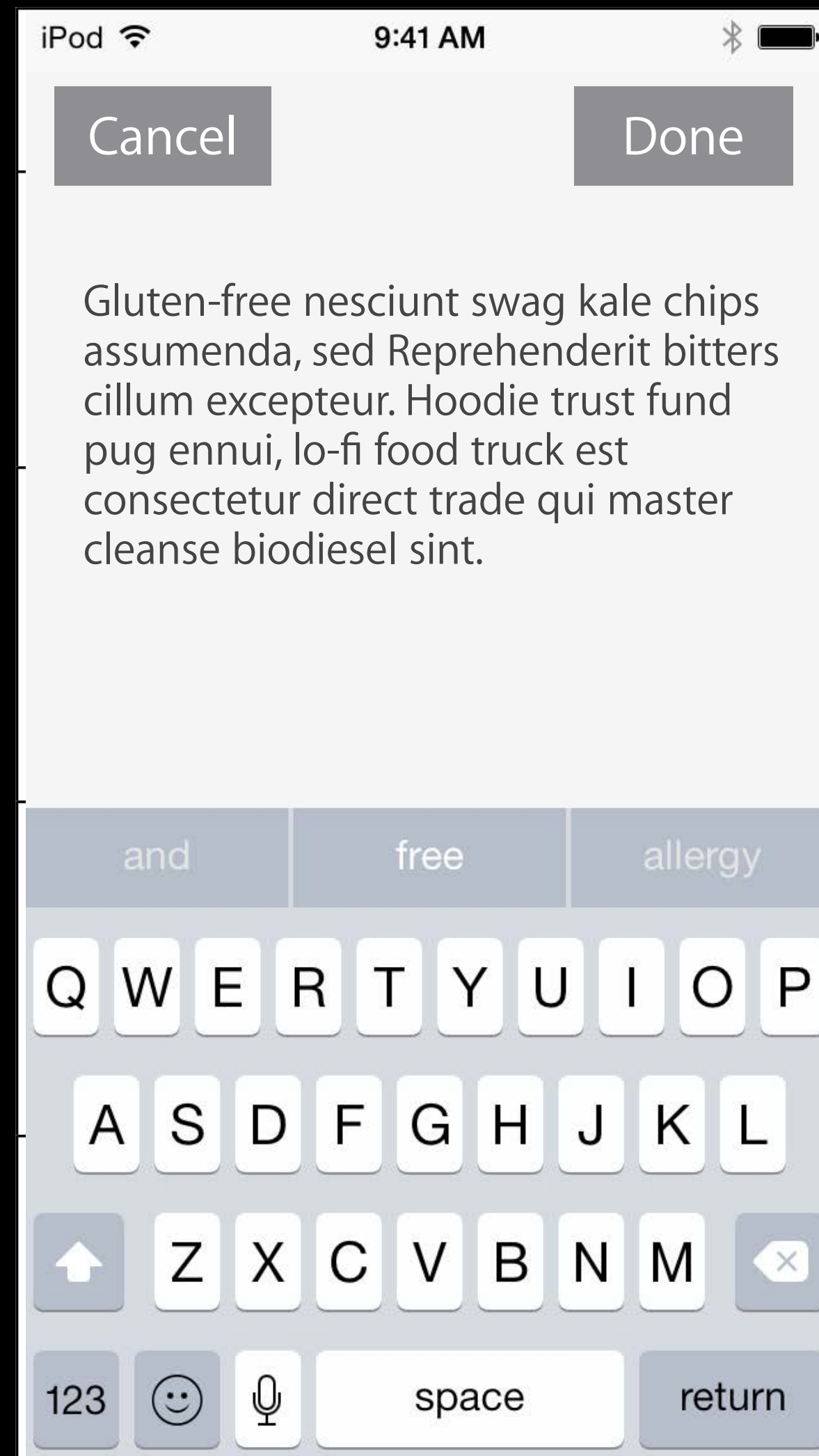
# Adding an Entry

## Target/Action



# Adding an Entry

## Target/Action

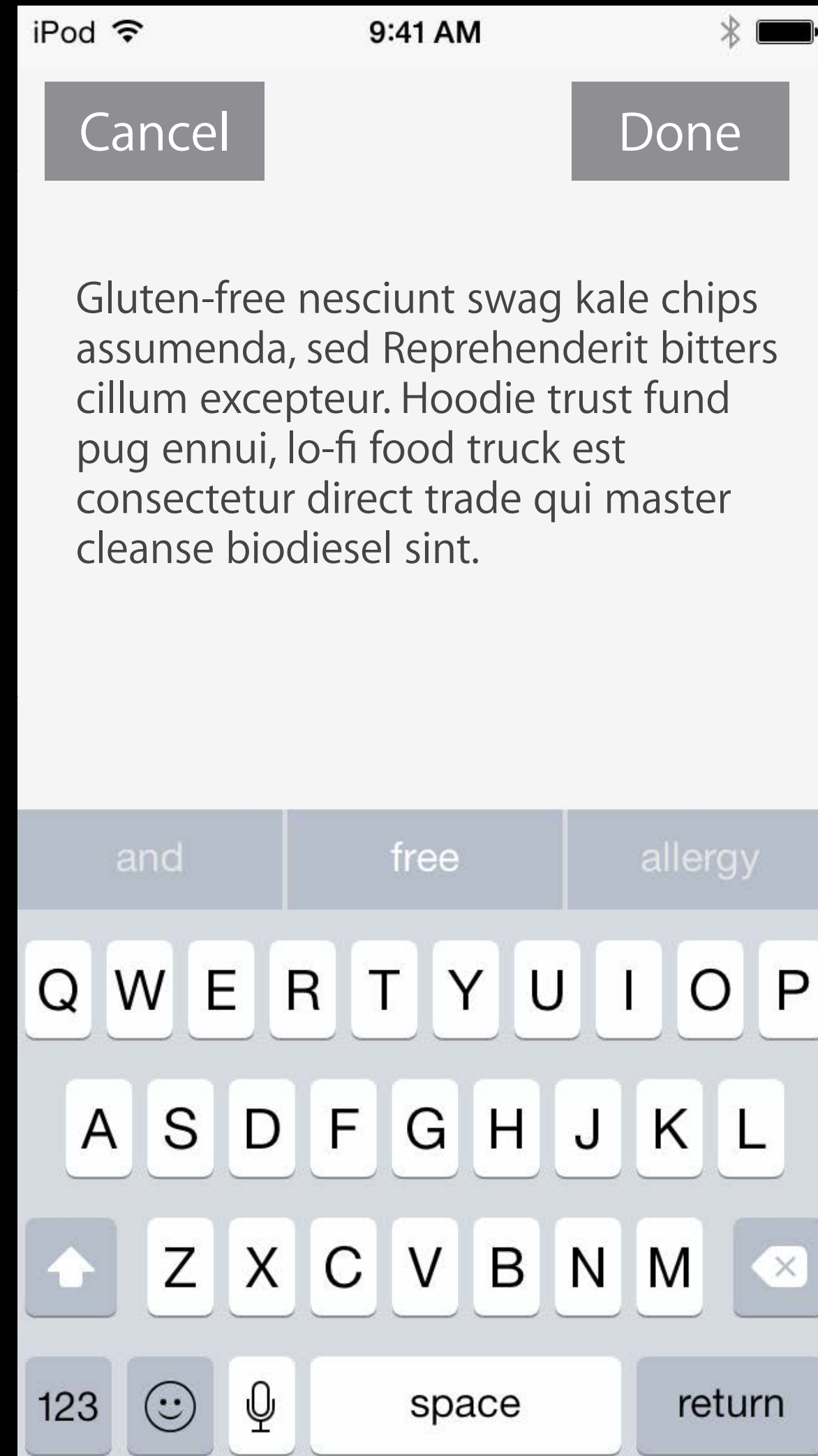


QwinkEntryViewController



# Model-View-Controller

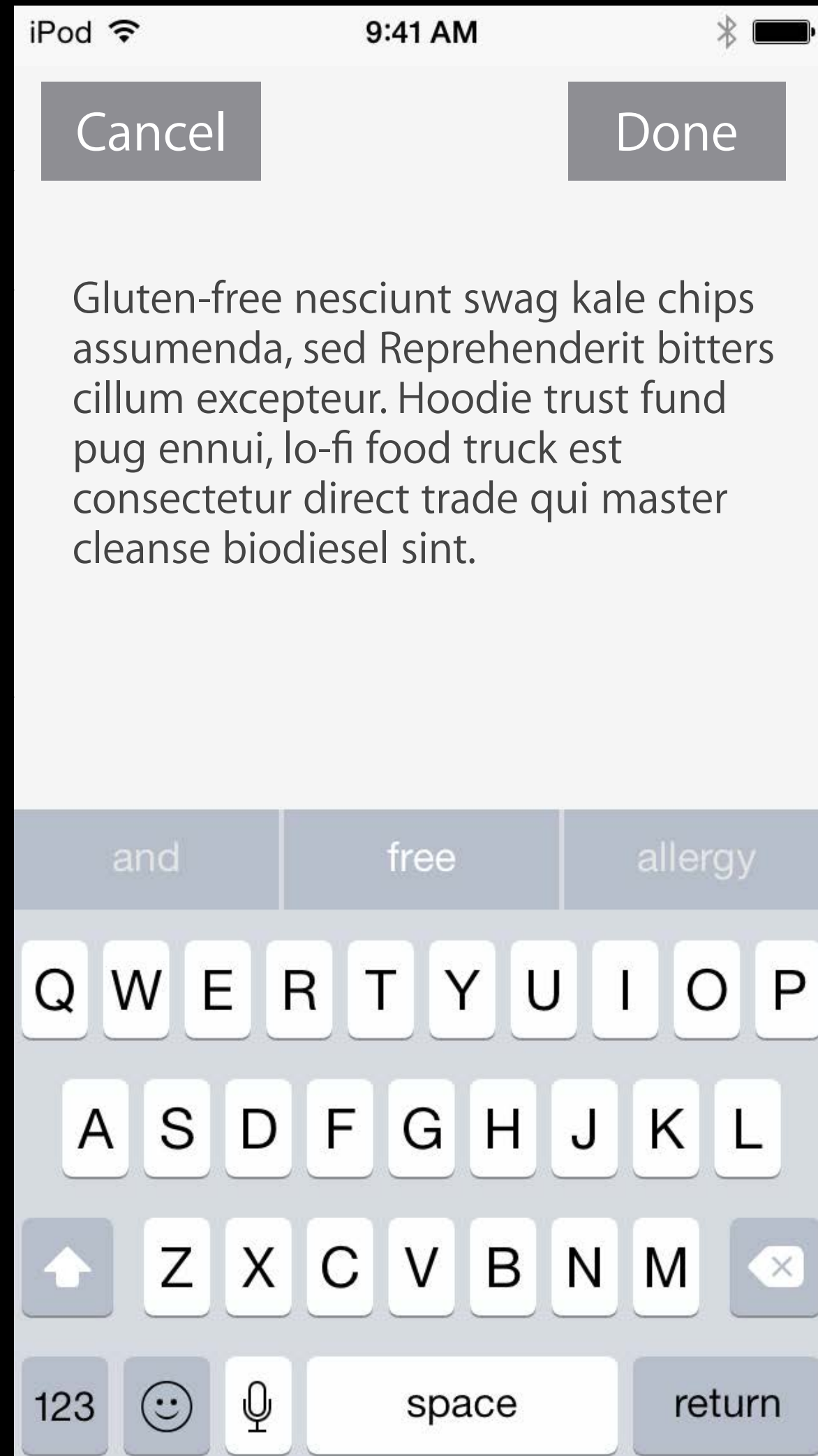
## Networking



Qwink Entry View Controller

# Model-View-Controller

## Networking



Qwink Entry View Controller

NSURLSession

# Qwinkle

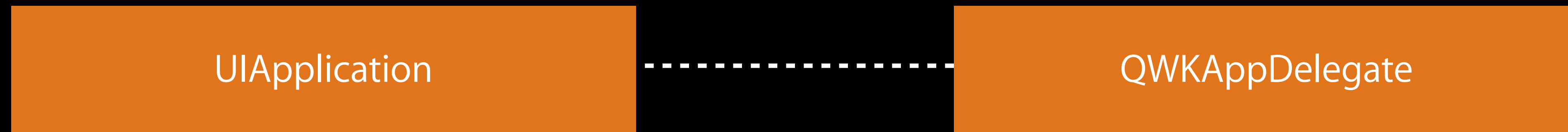
## Application level features



UIApplication

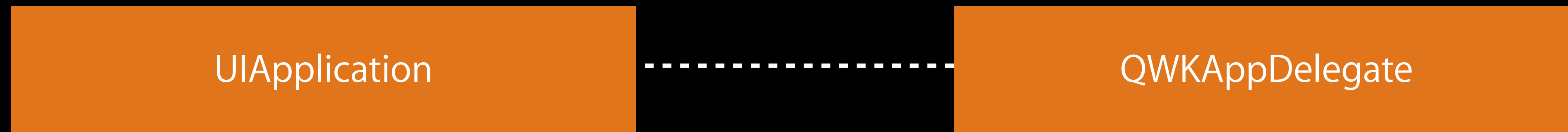
# Qwinkle

## Application level features



# Qwinkle

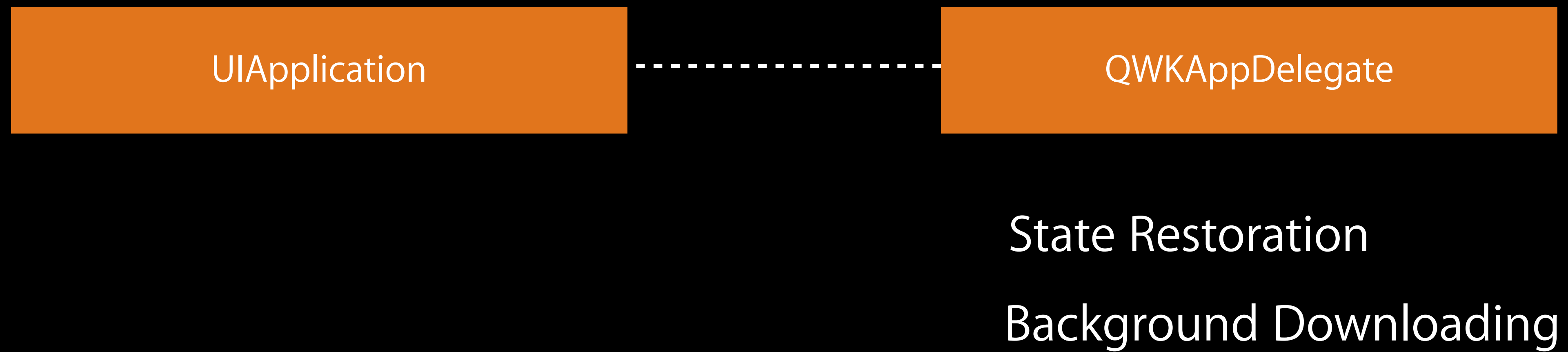
## Application level features



State Restoration

# Qwinkle

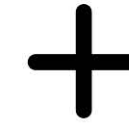
## Application level features



Change Happens

# Requirements Change

Qwinks



Porchetta t-bone meatloaf  
bresaola, ball tip short loin pig  
jerky brisket tongue bacon shank  
salami. Sirloin landjaeger pastrami  
shoulder beef shank, corned beef  
tail strip steak.



Distillery non post-ironic occupy  
photo booth. Tousled church-key  
laborum, four loko pork belly  
Vinegar twee chia jean shorts  
commodo.







Turducken cow drumstick, turkey  
flank tenderloin short ribs venison  
leberkas. T-bone hamburger  
fatback drumstick bacon salami  
pork biltong leberkas short loin  
shankle doner tri-tip



Tattooed keytar veniam, try-hard  
vegan assumenda quinoa  
chillwave. Viral sed, accusamus 90's  
adipisicing gentrify iPhone ethical  
flexitarian.







# Requirements Change

Qwinks +	
	Porchetta t-bone meatloaf bresaola, ball tip short loin pig jerky brisket tongue bacon shank salami. Sirloin landjaeger pastrami shoulder beef shank, corned beef tail strip steak.
	Distillery non post-ironic occupy photo booth. Tousled church-key laborum, four loko pork belly Vinegar twee chia jean shorts commodo.
	Turducken cow drumstick, turkey flank tenderloin short ribs venison leberkas. T-bone hamburger fatback drumstick bacon salami pork biltong leberkas short loin shankle doner tri-tip
	Tattooed keytar veniam, try-hard vegan assumenda quinoa chillwave. Viral sed, accusamus 90's adipisicing gentrify iPhone ethical flexitarian.
Qwinks	PQ





Private Qwinks +	
 <p>Pork belly sausage capicola porchetta bresaola. Corned beef turkey boudin, ribeye shankle tongue pig cow short ribs frankfurter pork chop landjaeger.</p>	
	
 <p>Brooklyn readymade dreamcatcher, mumblecore roof party actually normcore plaid 90's quinoa kogi scenester.</p>	
	
Qwinks	PQ

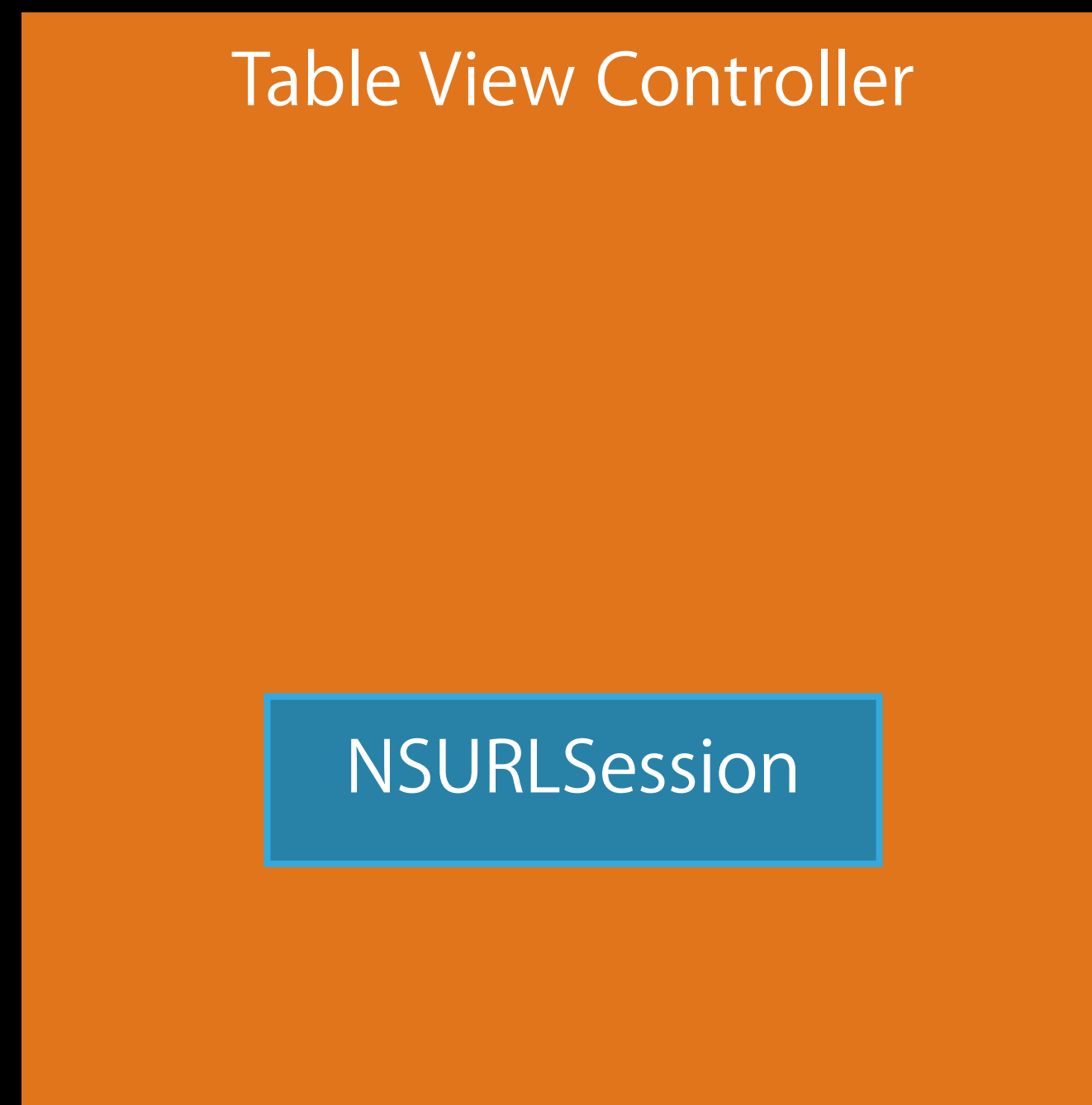
# Requirements Change

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Qwinks	PQ





# Requirements Change

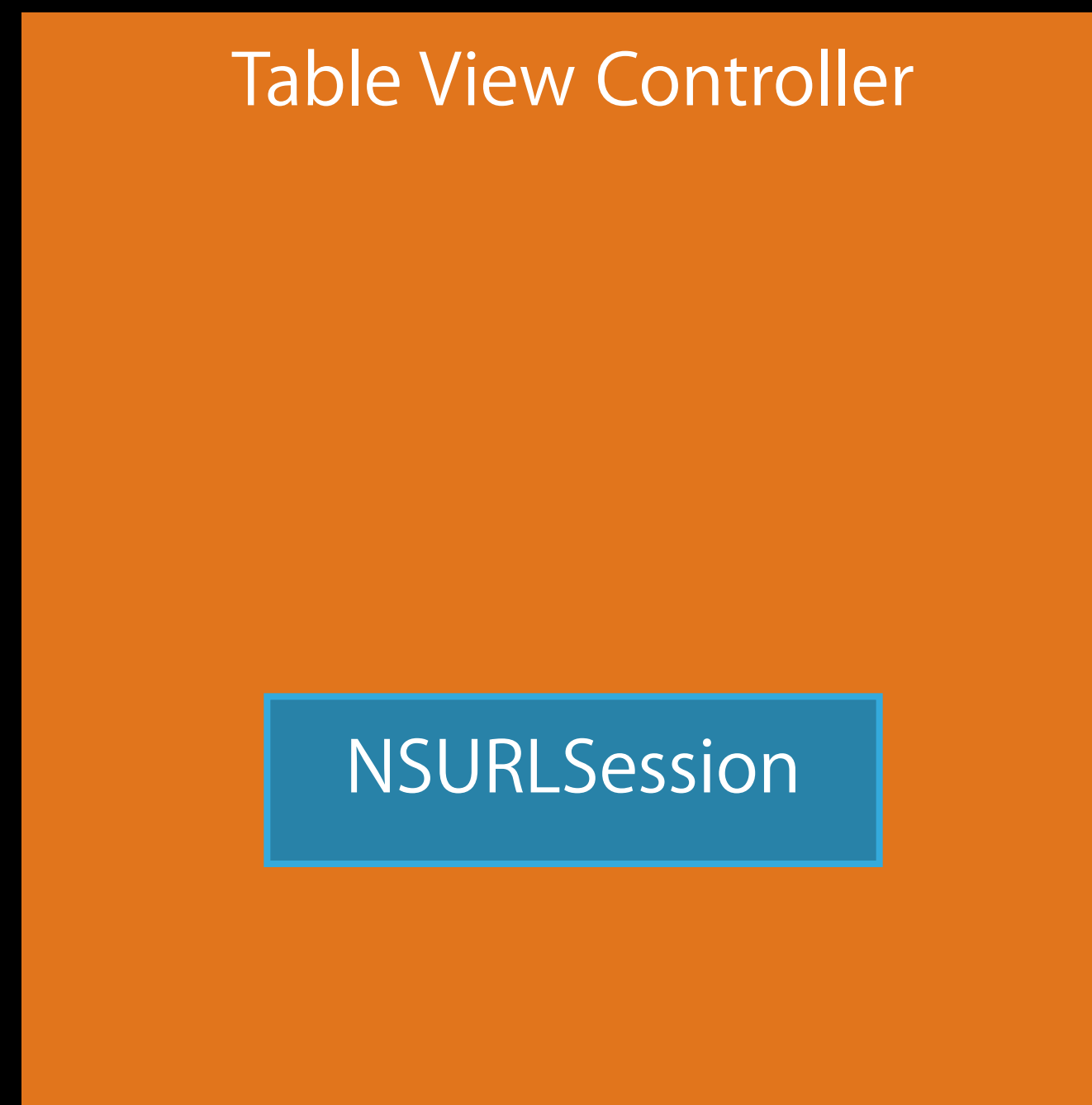
Qwinks +	
	T-bone meatloaf bresaola, ball tip short loin pig jerky brisket tongue bacon shank salami. Sirloin landjaeger pastrami shoulder beef shank, corned beef tail strip steak.
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Qwinks	PQ

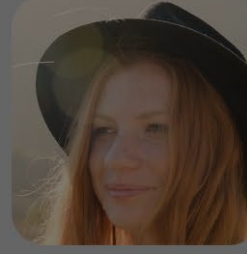



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	 <p>Pork belly sausage capicola porchetta bresaola. Corned beef turkey boudin, ribeye shankle tongue pig cow short ribs frankfurter pork chop landjaeger.</p>
	
	 <p>Brooklyn readymade dreamcatcher, mumblecore roof party actually normcore plaid 90's quinoa kogi scenester.</p>
	
Qwinks	PQ





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Qwinks	PQ

# Copy and Paste

Qwinks +	
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Qwinks	PQ

PublicTimelineViewController





NSURLSession

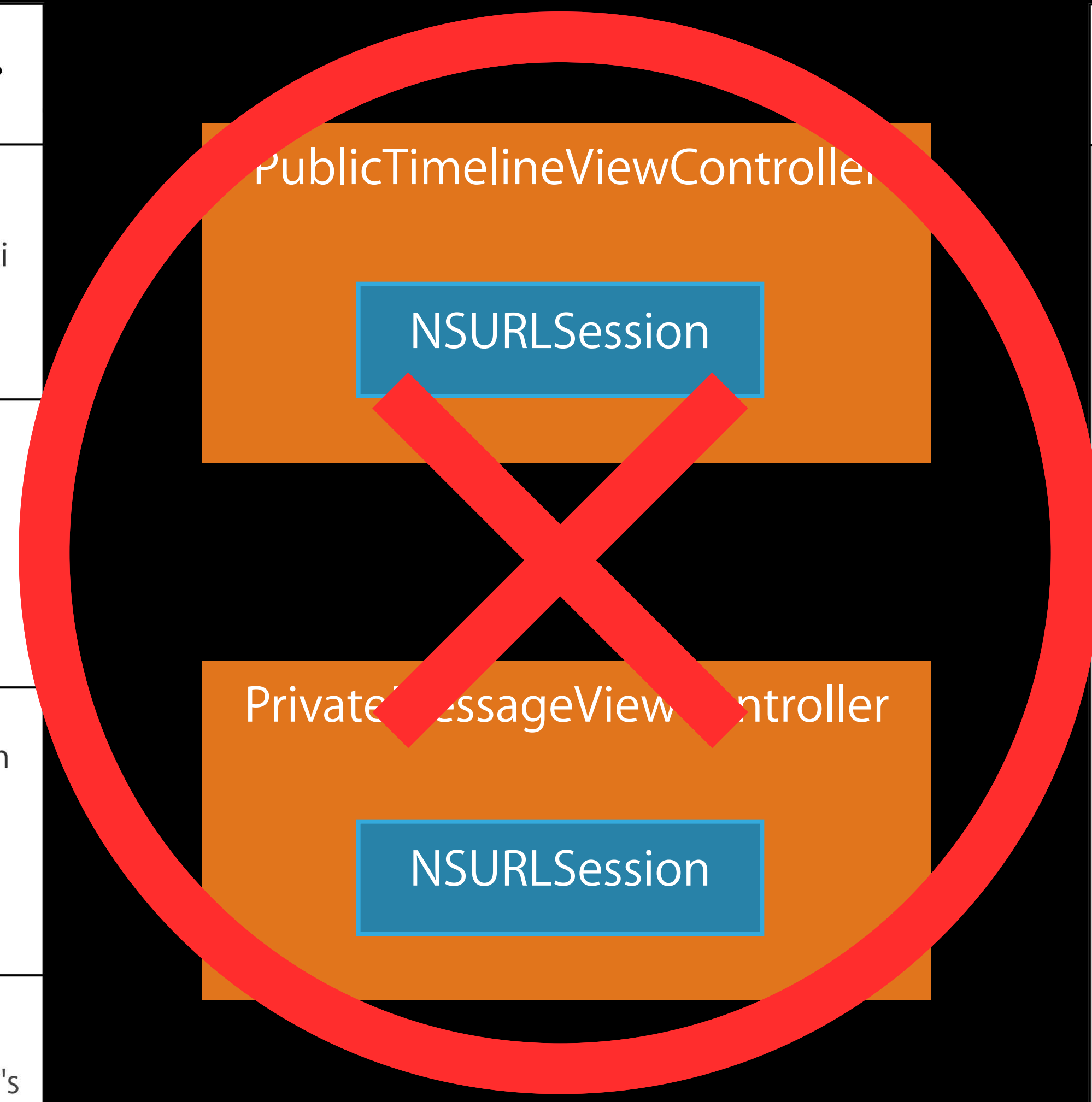
PrivateMessageViewController

NSURLSession

Private Qwinks +	
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Qwinks	PQ

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Qwinks	PQ

# Refactor


## Qwinks +




Porchetta t-bone meatloaf bresaola, ball tip short loin pig jerky brisket tongue bacon shank salami. Sirloin landjaeger pastrami shoulder beef shank, corned beef tail strip steak.



Distillery non post-ironic occupy photo booth. Tousled church-key laborum, four loko pork belly Vinegar twee chia jean shorts commodo.

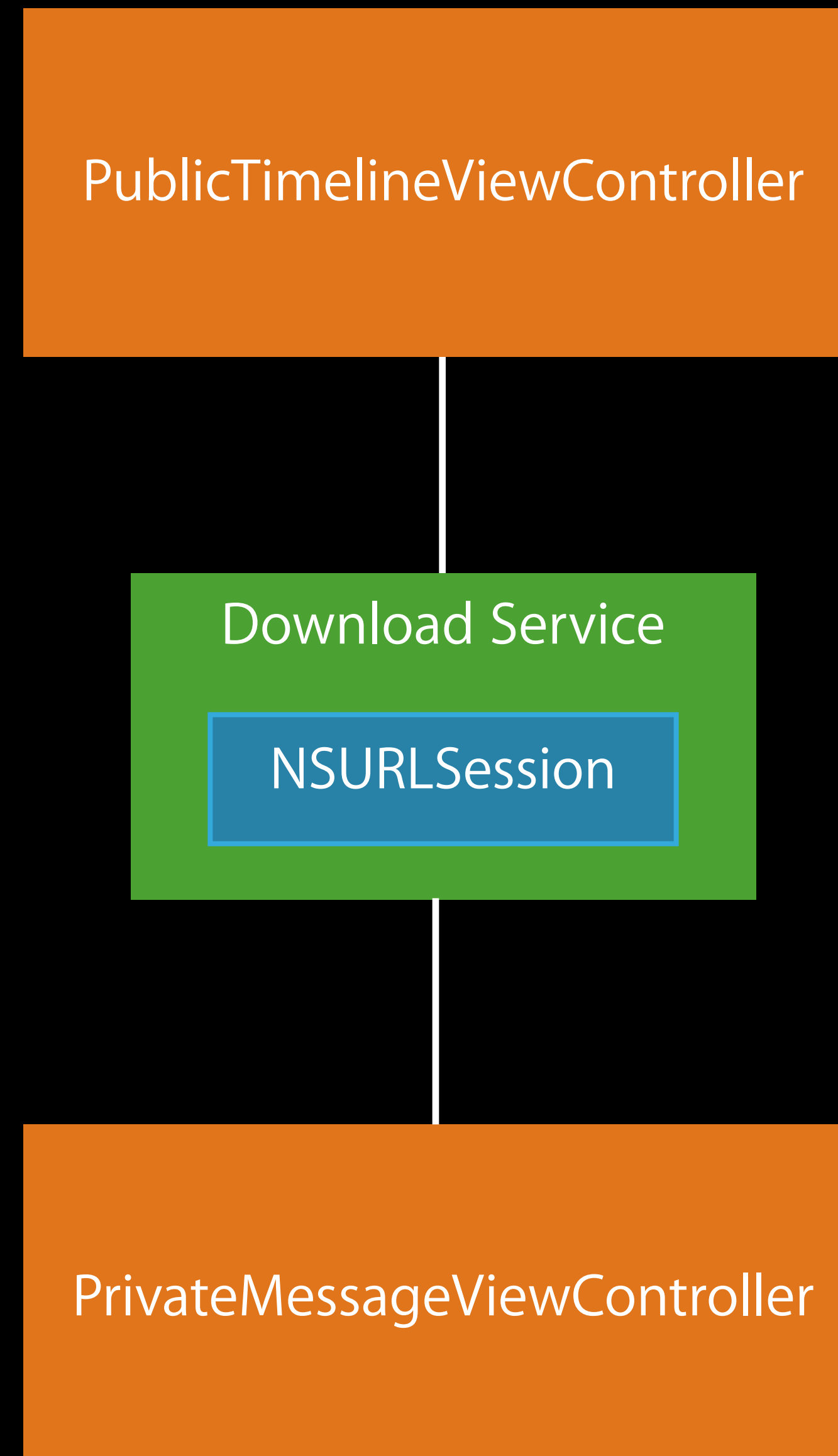


Turducken cow drumstick, turkey flank tenderloin short ribs venison leberkas. T-bone hamburger fatback drumstick bacon salami pork biltong leberkas short loin shankle doner tri-tip



Tattooed keytar veniam, try-hard vegan assumenda quinoa chillwave. Viral sed, accusamus 90's adipisicing gentrify iPhone ethical flexitarian.

Qwinks	PQ
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## Private Qwinks +



Pork belly sausage capicola porchetta bresaola. Corned beef turkey boudin, ribeye shankle tongue pig cow short ribs frankfurter pork chop landjaeger.



Brooklyn readymade dreamcatcher, mumblecore roof party actually normcore plaid 90's quinoa kogi scenester.

Qwinks	PQ
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# Refactor

PublicTimelineViewController



# Refactor

PublicTimelineViewController

Download Service



# Refactor

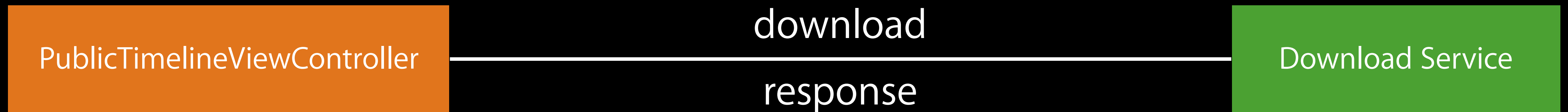
PublicTimelineViewController

download

Download Service



# Refactor



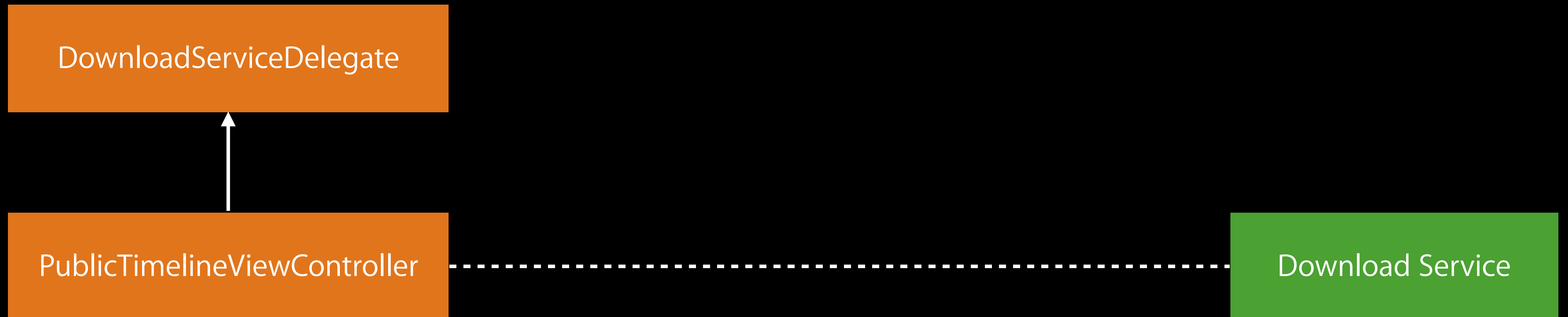
# Refactor

PublicTimelineViewController

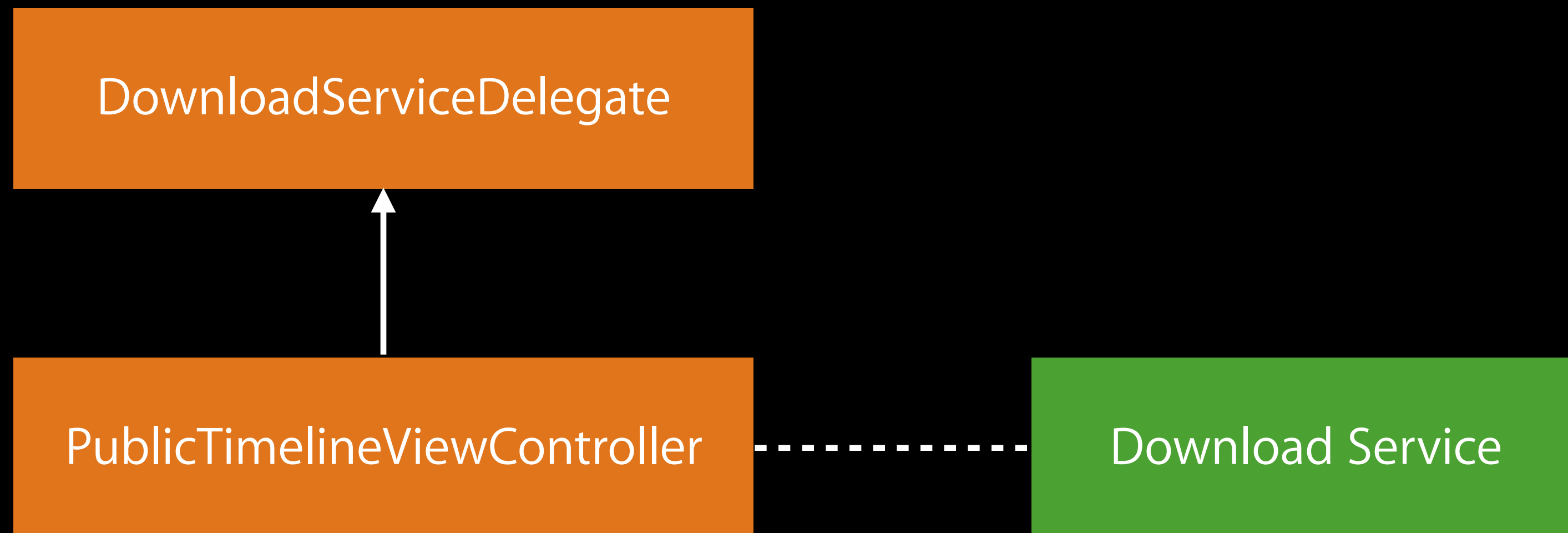
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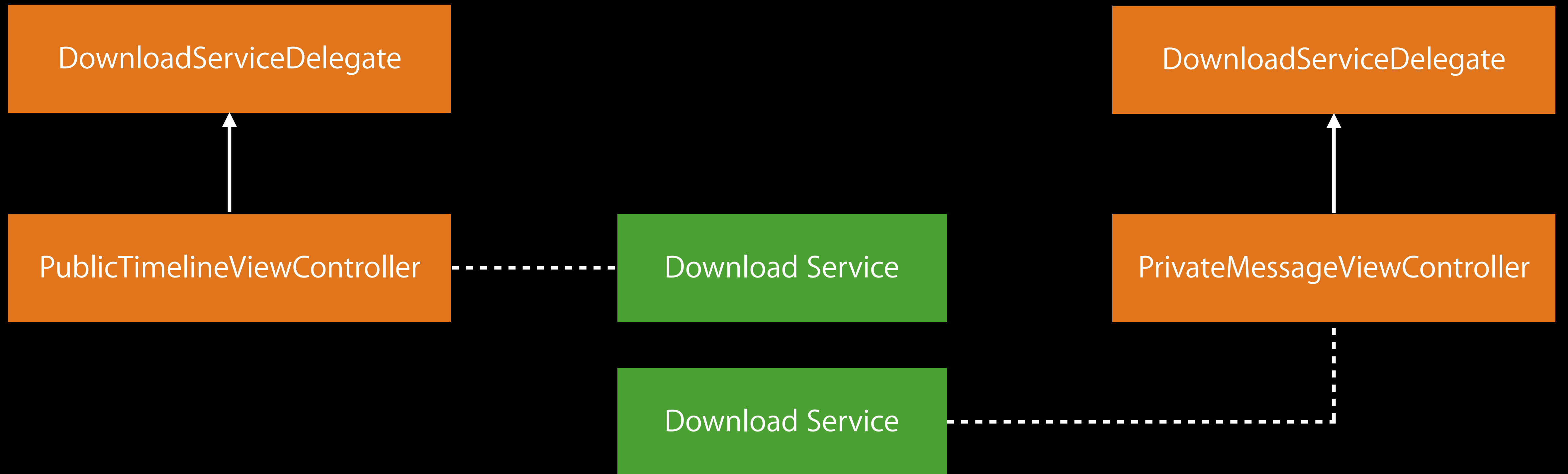
# Refactor



# Refactor



# Refactor



*Demo*



# Summary

# Summary



Summary

# More Information

Jake Behrens

Grand Pooh-Bah Of Groovy

[behrens@apple.com](mailto:behrens@apple.com)

Apple Developer Forums

<http://devforums.apple.com>

# Related Sessions

- 
- Advanced iOS Application Architecture and Patterns      Presidio      Thursday 2:00PM

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  - What's New in Foundation Networking      WWDC 2013

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  - API Design for Cocoa and Cocoa Touch      WWDC 2010

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 WWDC14