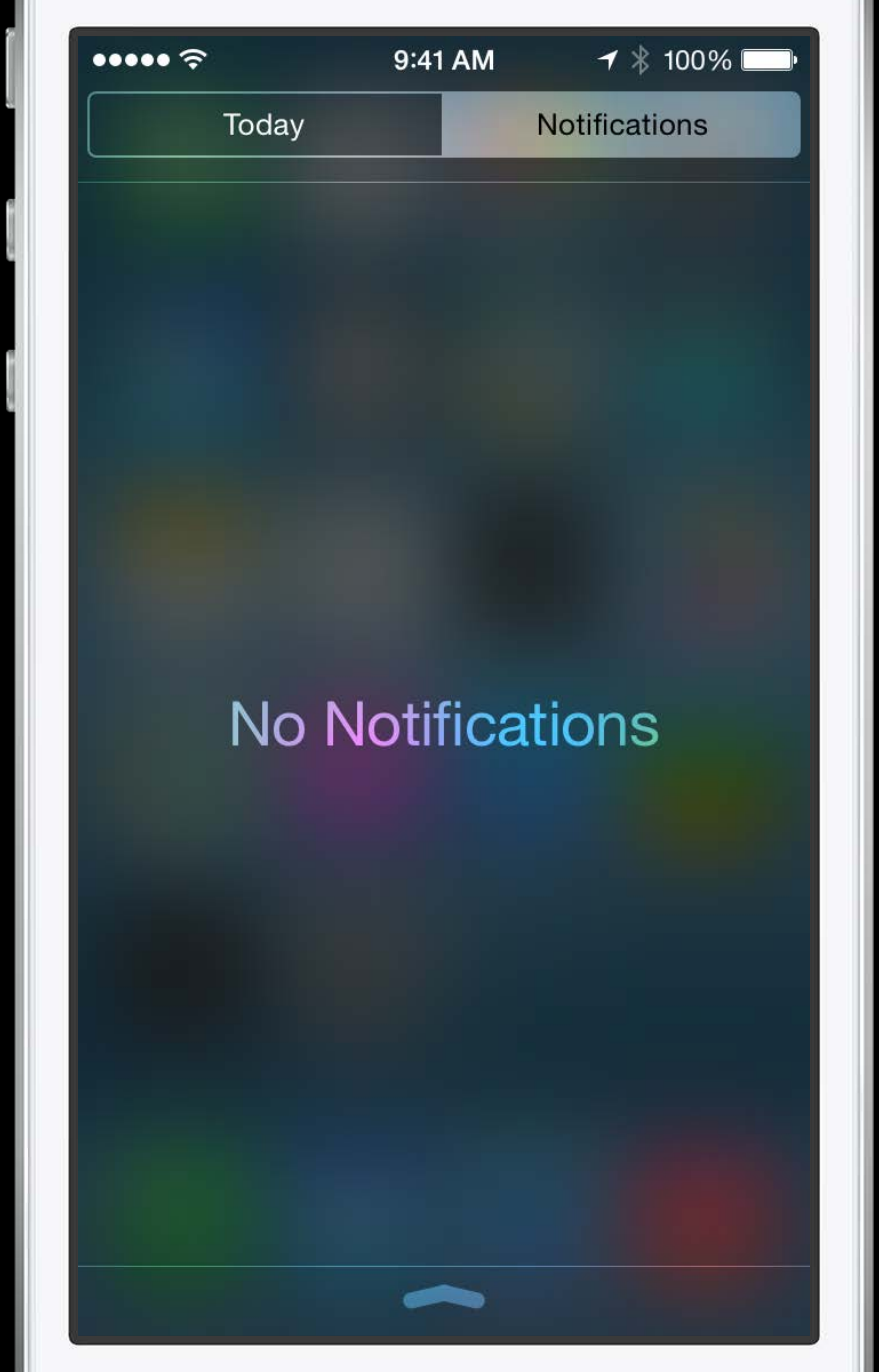
Creating Custom iOS User Interfaces

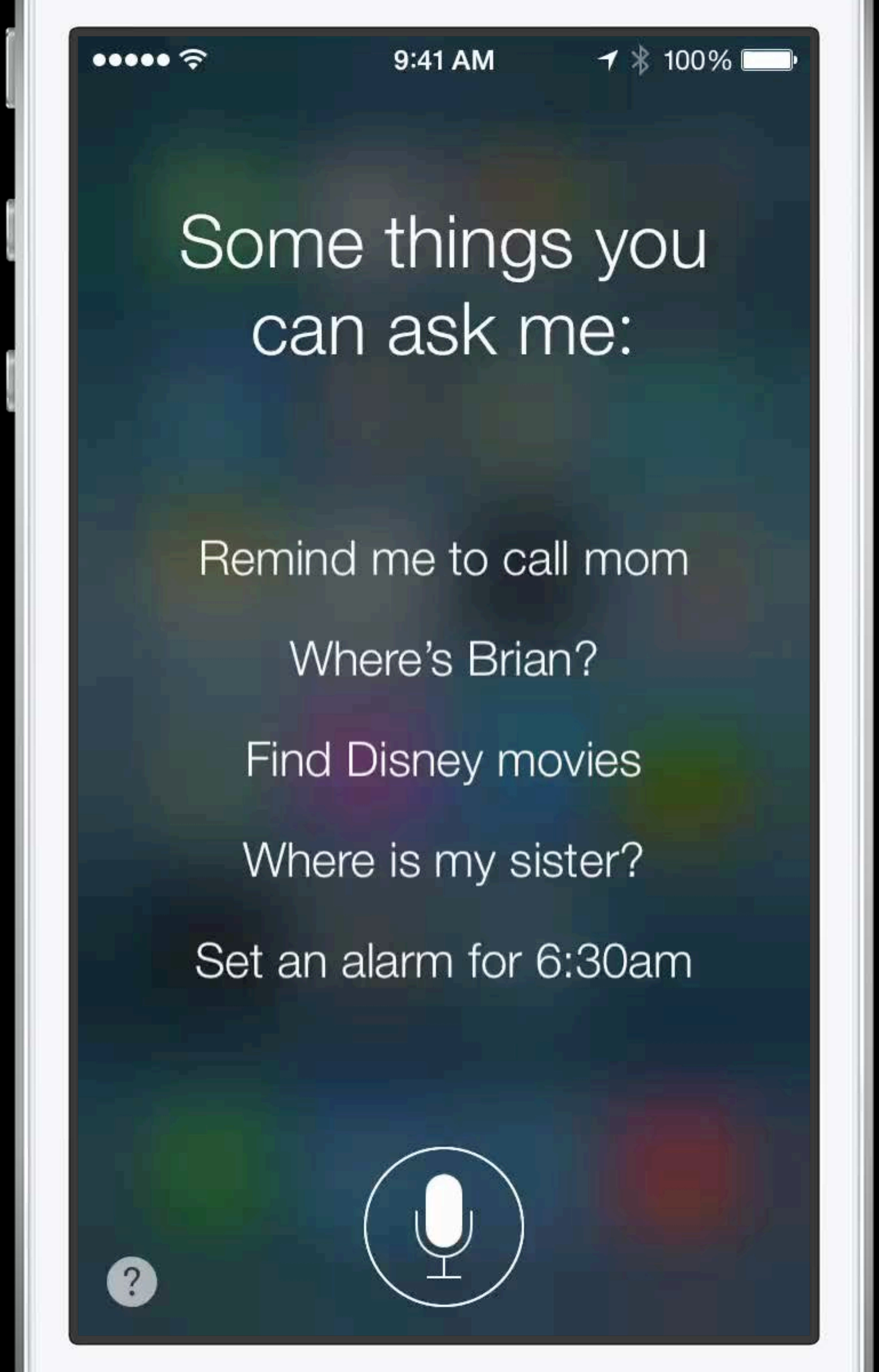
Make your app stand out

Session 221

Brandon Newendorp
iOS Software Engineer



No Notifications



Some things you can ask me:

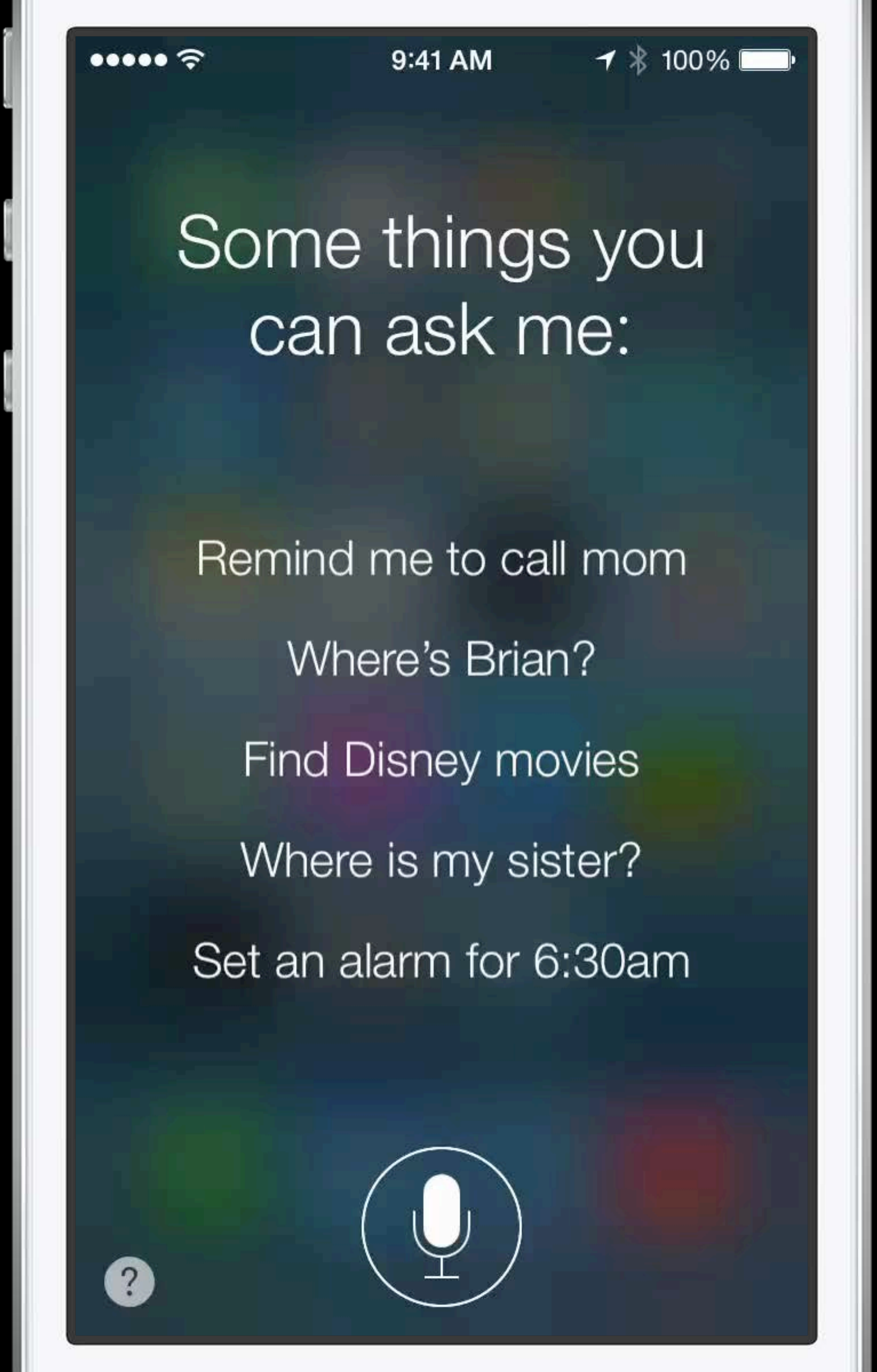
Remind me to call mom

Where's Brian?

Find Disney movies

Where is my sister?

Set an alarm for 6:30am



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When Should You Build Custom UI?

Questions to ask

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Where will this be used?

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Does it need to support multiple states?

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Can this be shared across several apps?

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What APIs can be leveraged?

When Should You Build Custom UI?

Take advantage of existing API

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Take advantage of existing API

UIAppearance

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Take advantage of existing API

UIAppearance

- UIImageRenderingMode

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Dynamic Type

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UIAppearance

- UIImageRenderingMode

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Accessibility

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Dynamic Type

Accessibility

Localization

Agenda

Agenda

Spring animations

Agenda

Spring animations

Vibrancy and blur

Agenda

Spring animations

Vibrancy and blur

Shape layers

Agenda

Spring animations

Vibrancy and blur

Shape layers

Dynamic Core Animation behaviors

Spring Animations

More natural animation curves

Spring Animations

What are they?

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Not necessarily a bouncy, spring-like behavior

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Spring Animations

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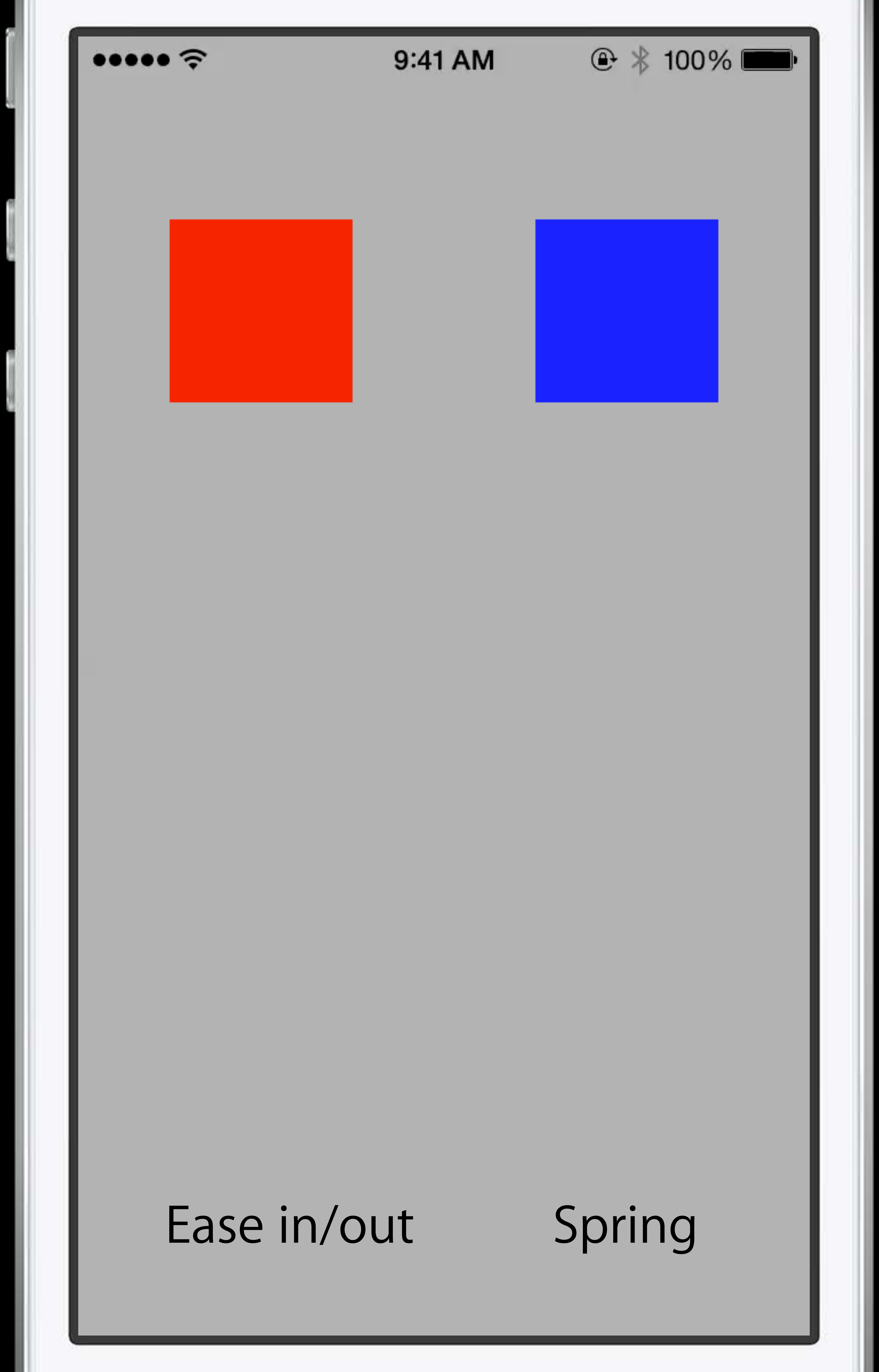
Different timing curve for animations

Used for nearly every system animation starting in iOS 7

Don’t require the use of UIKit Dynamics

Nearly the same API as UIView’s `animateWithDuration:`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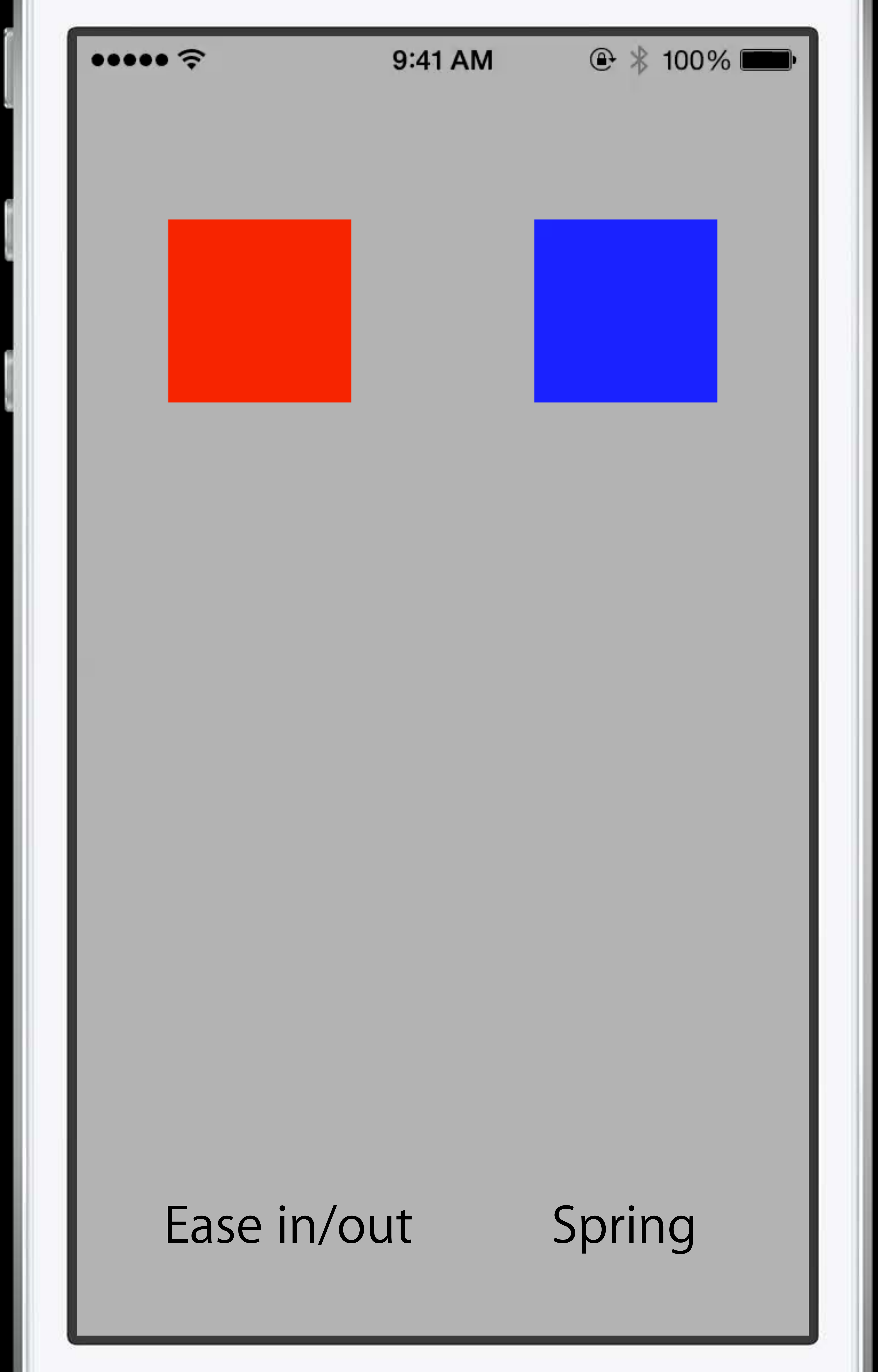
100%
Ease in/out
Spring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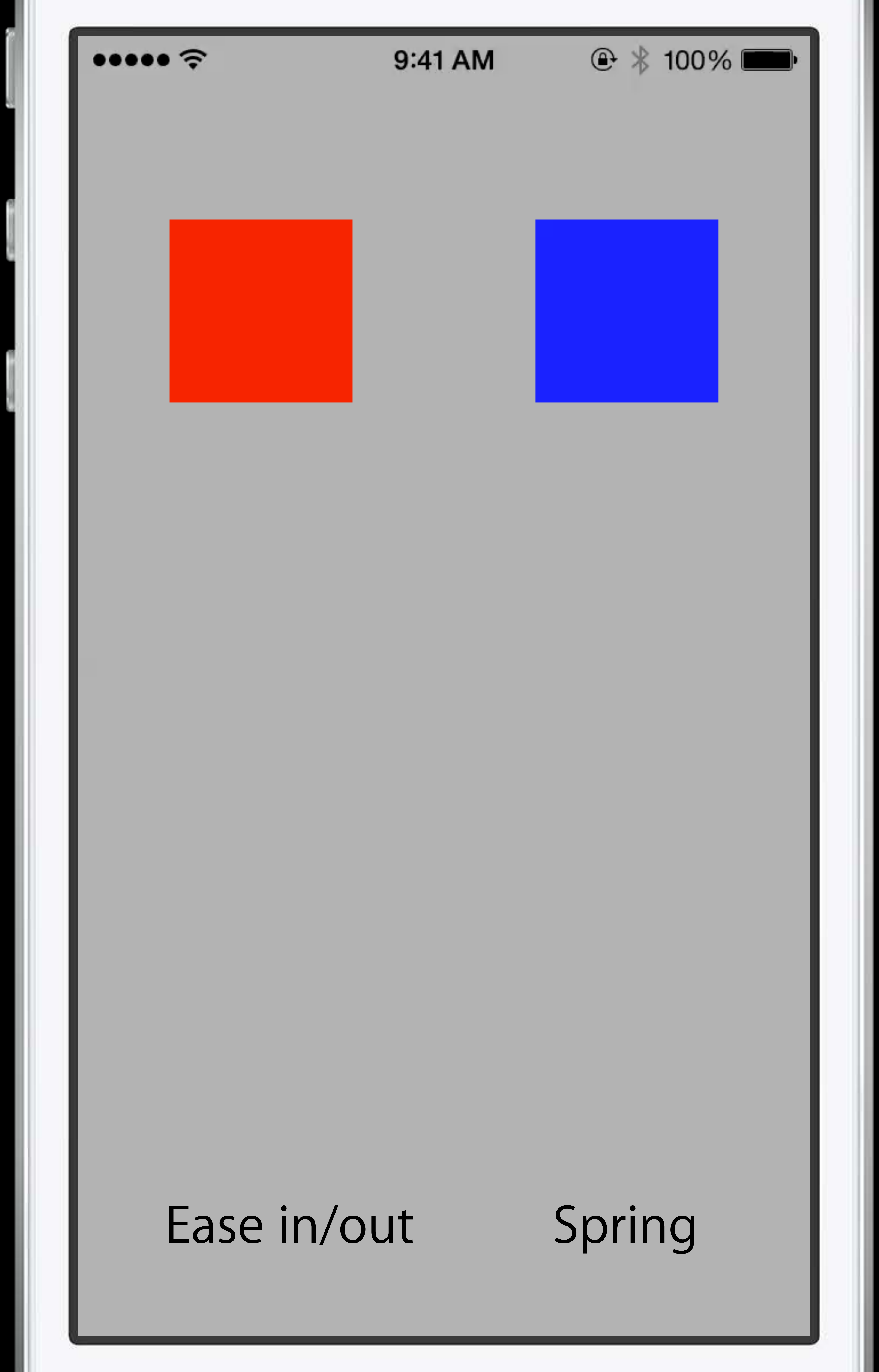
100%
Ease in/out
Spring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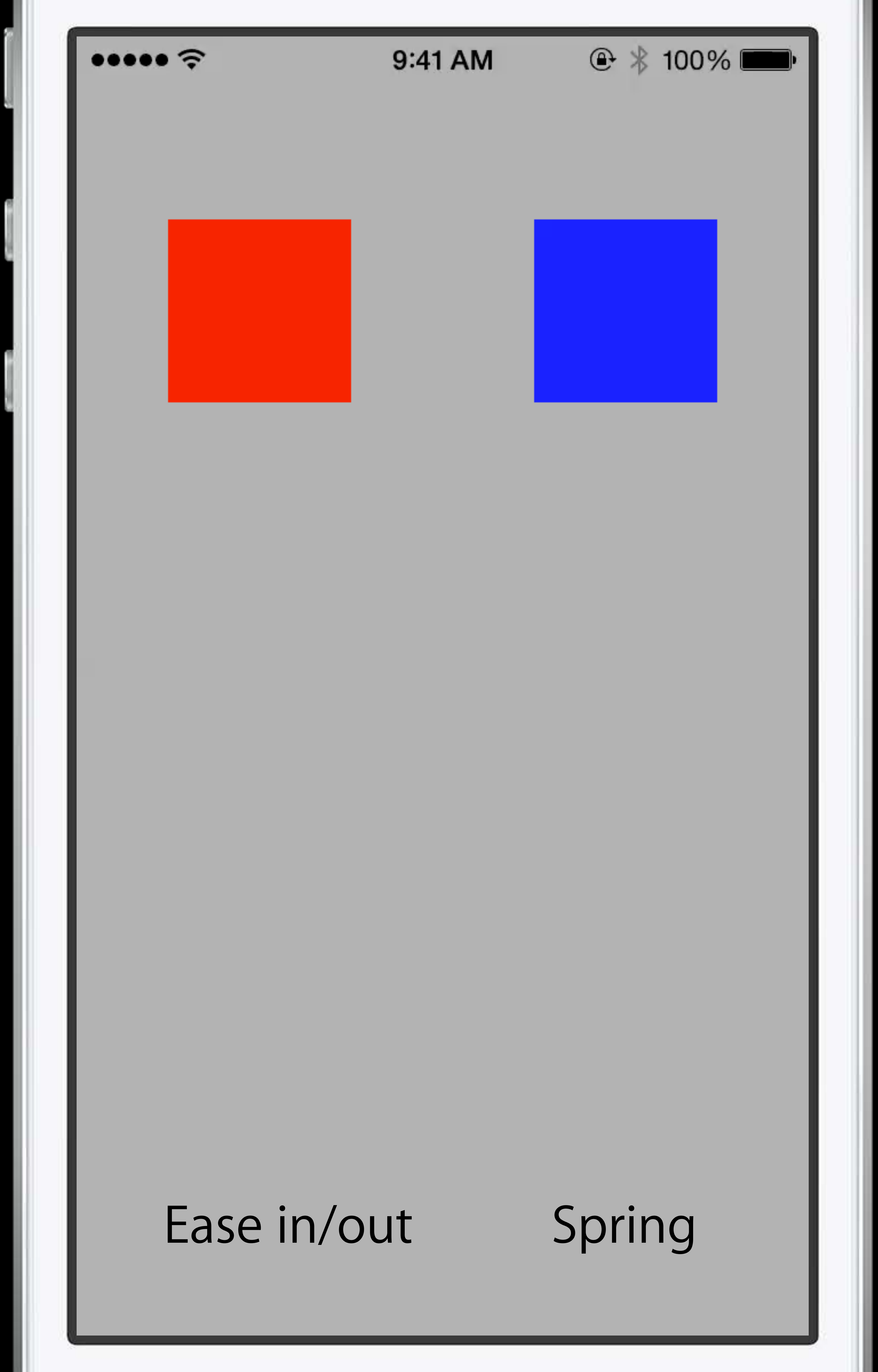
100%
Ease in/out
Spring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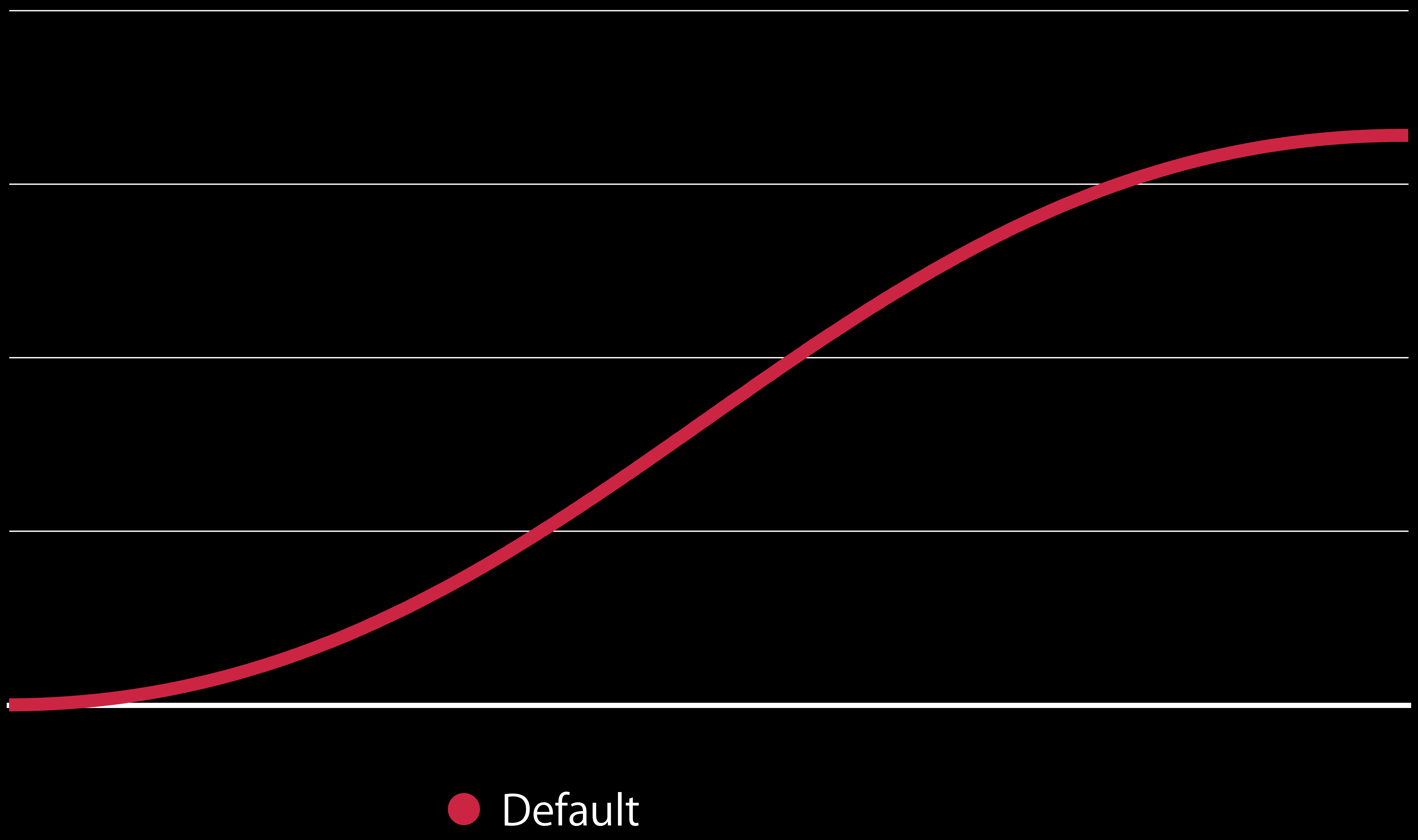
100%
Ease in/out
Spring

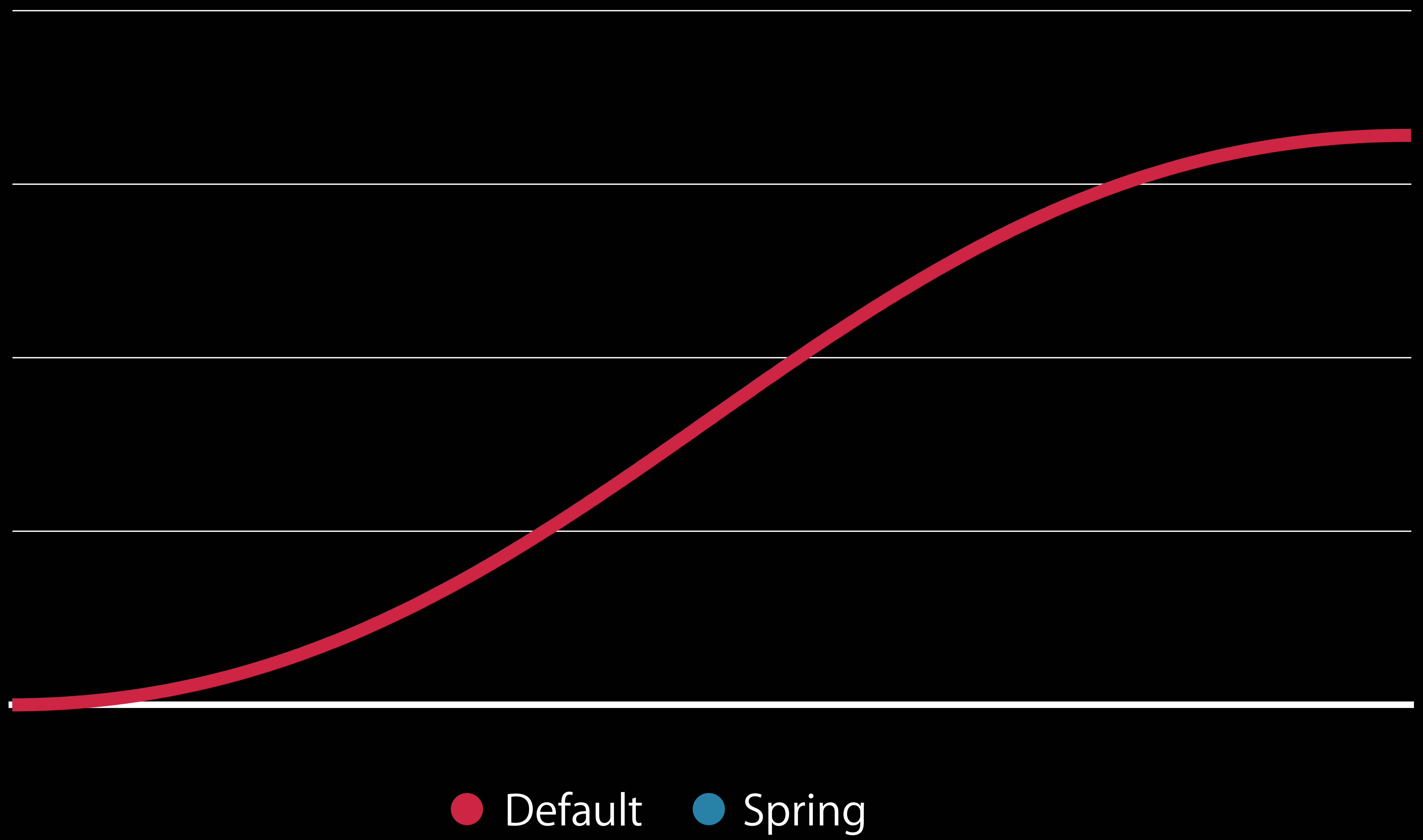
Spring Animations

What they do



Spring Animations

What they do



Spring Animations

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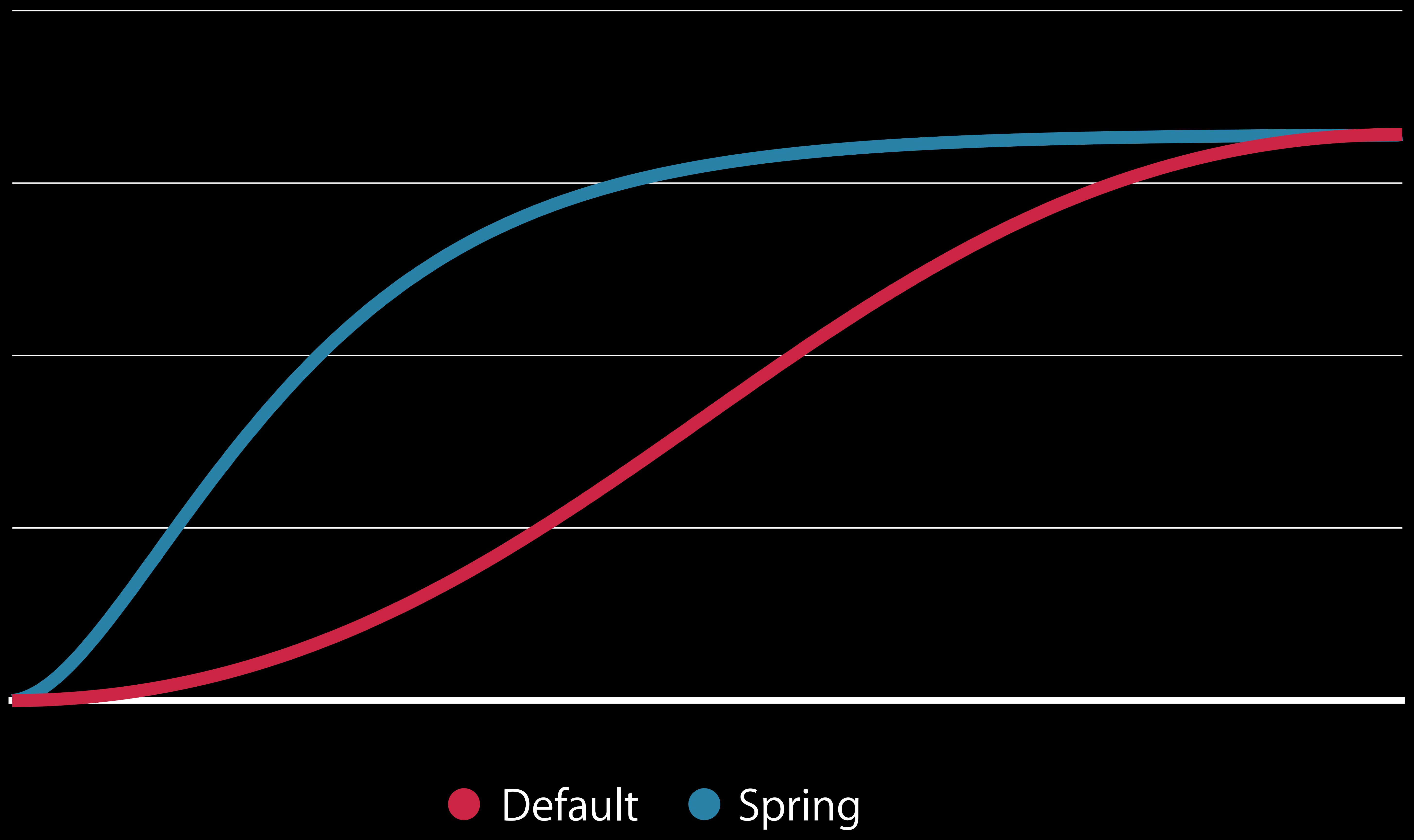

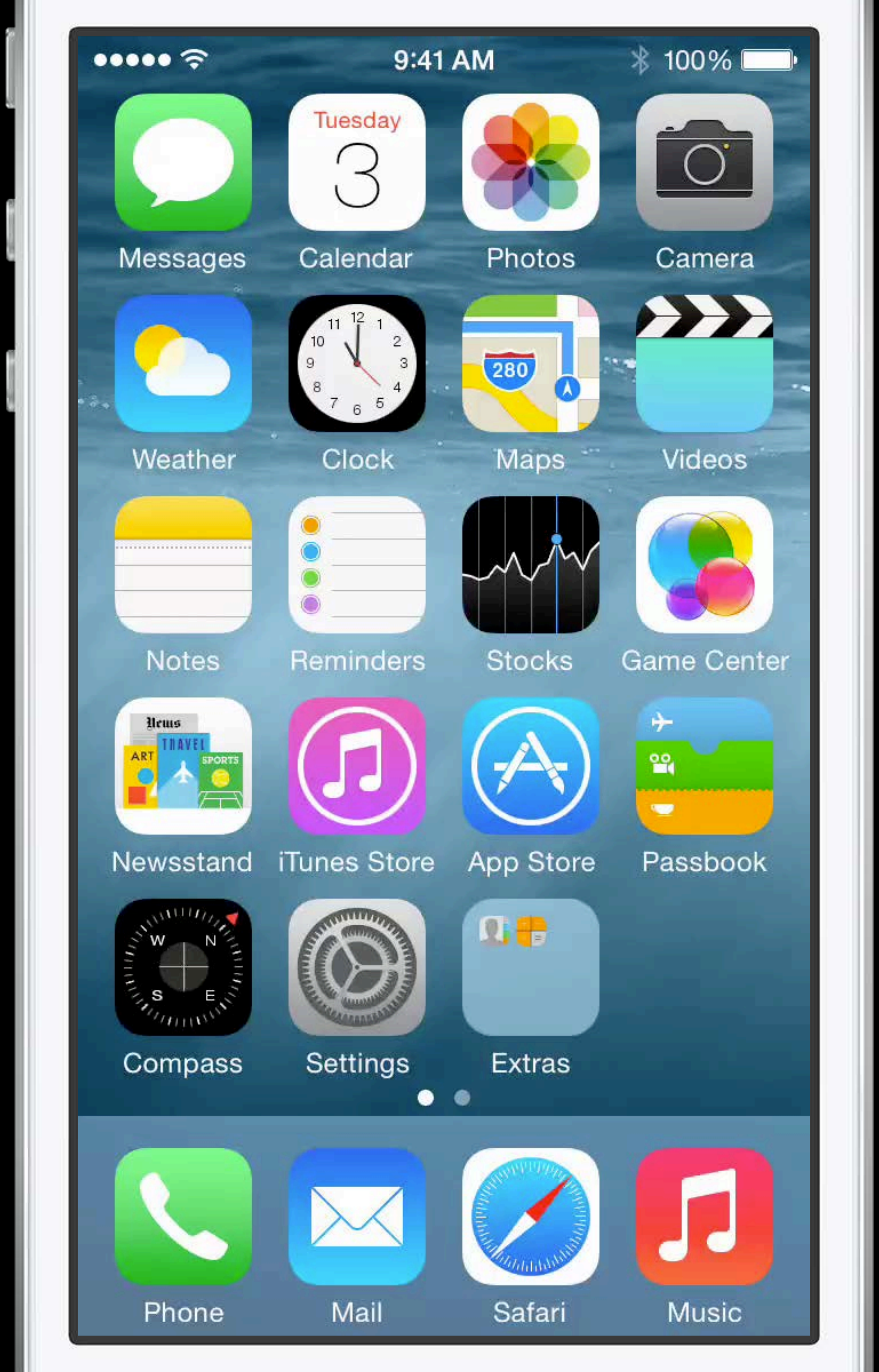
9:41 AM
100%
Tuesday
3
Messages
Calendar
Photos
Camera
Weather
Clock
Maps
Videos
Notes
Reminders
Stocks
Game Center
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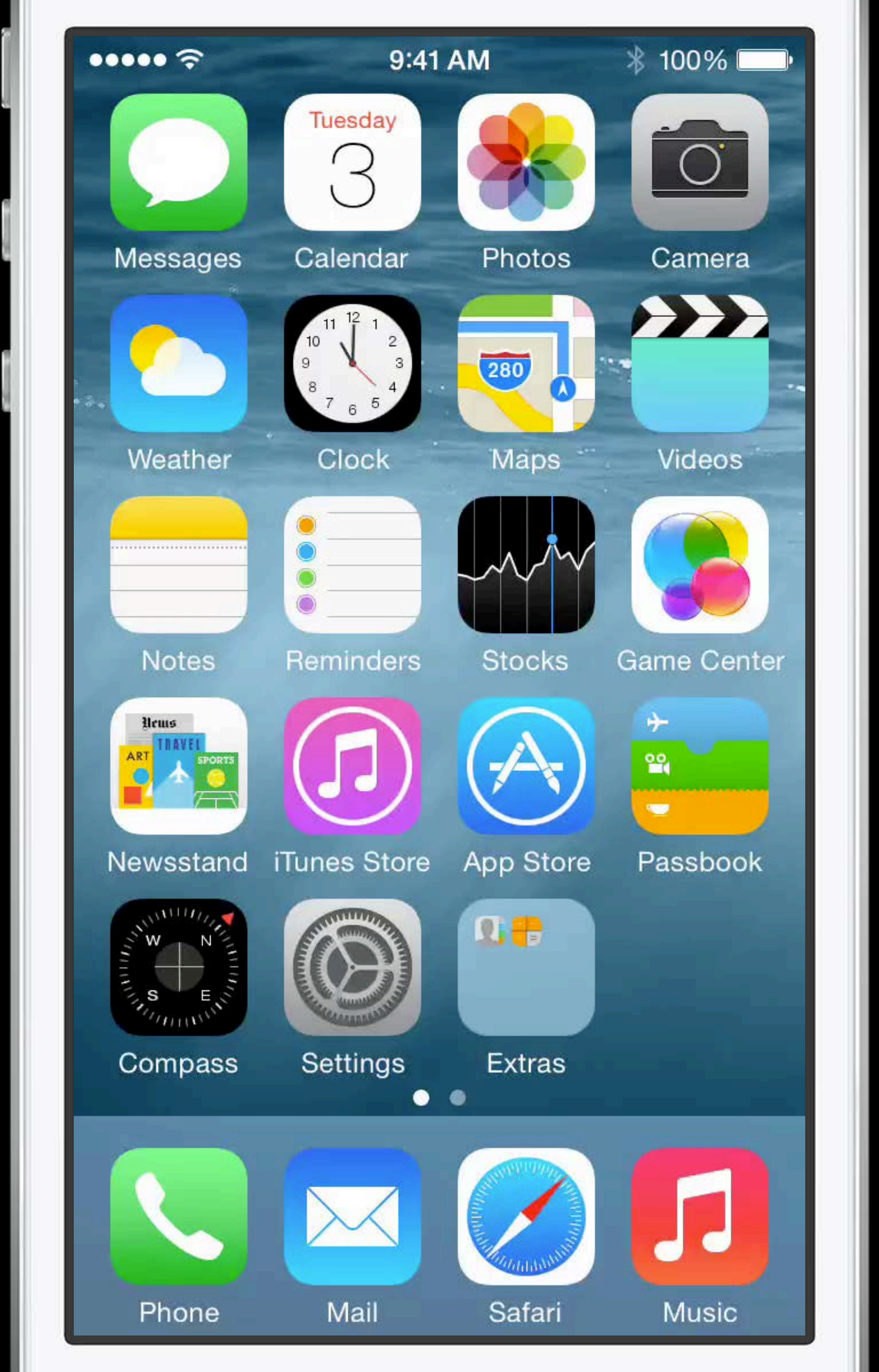
App Store
Passbook
Compass
Settings
Extras
Phone
Mail
Safari
Music


9:41 AM
100%
Tuesday
3
Messages
Calendar
Photos
Camera
280
Weather
Clock
Maps
Videos
Notes
Reminders
Stocks
Game Center
News
ART
TRAVEL
SPORTS
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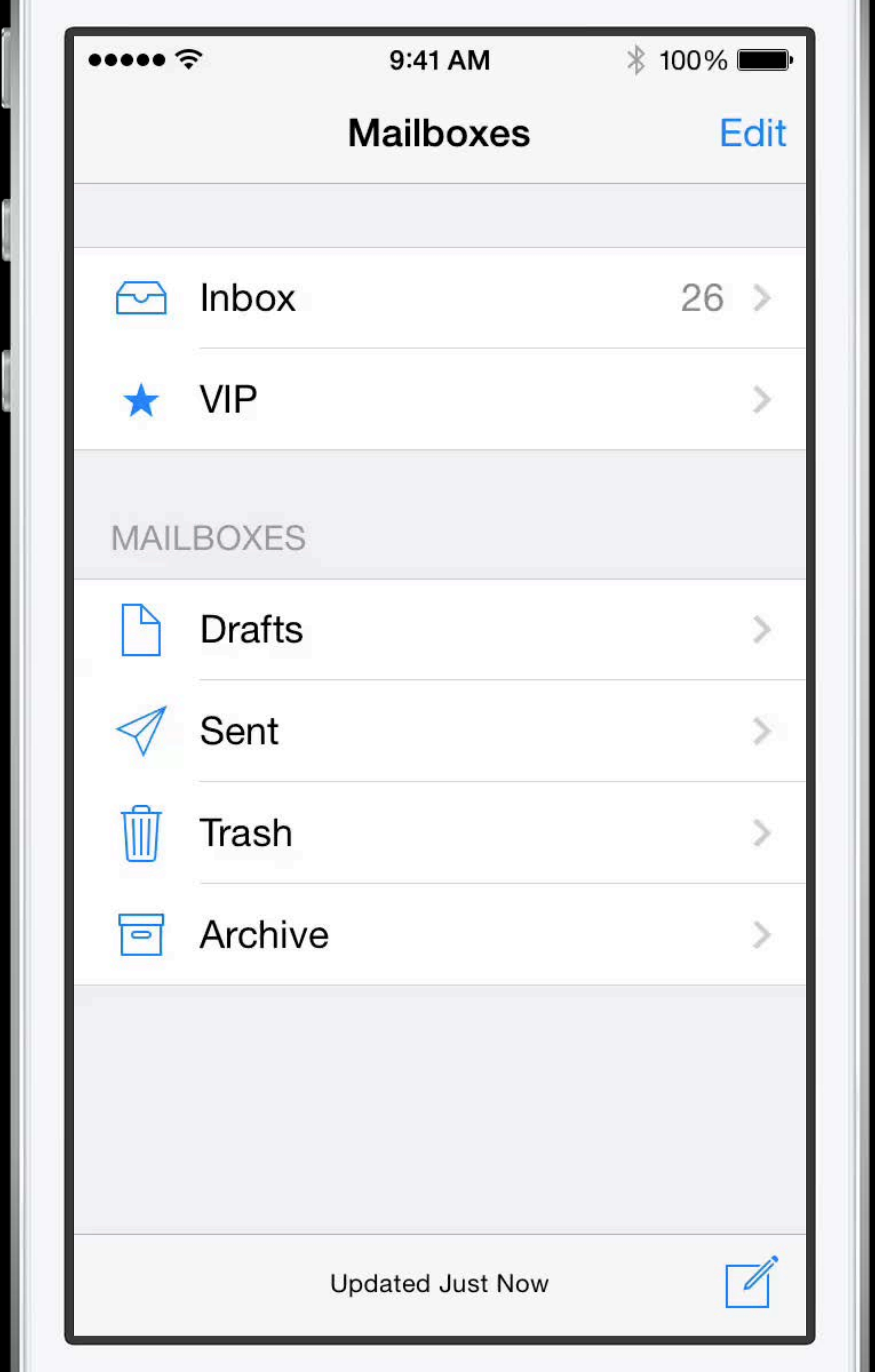
Settings
Extras
Phone
Mail
Safari
Music



Mailboxes

Inbox 26

VIP

MAILBOXES

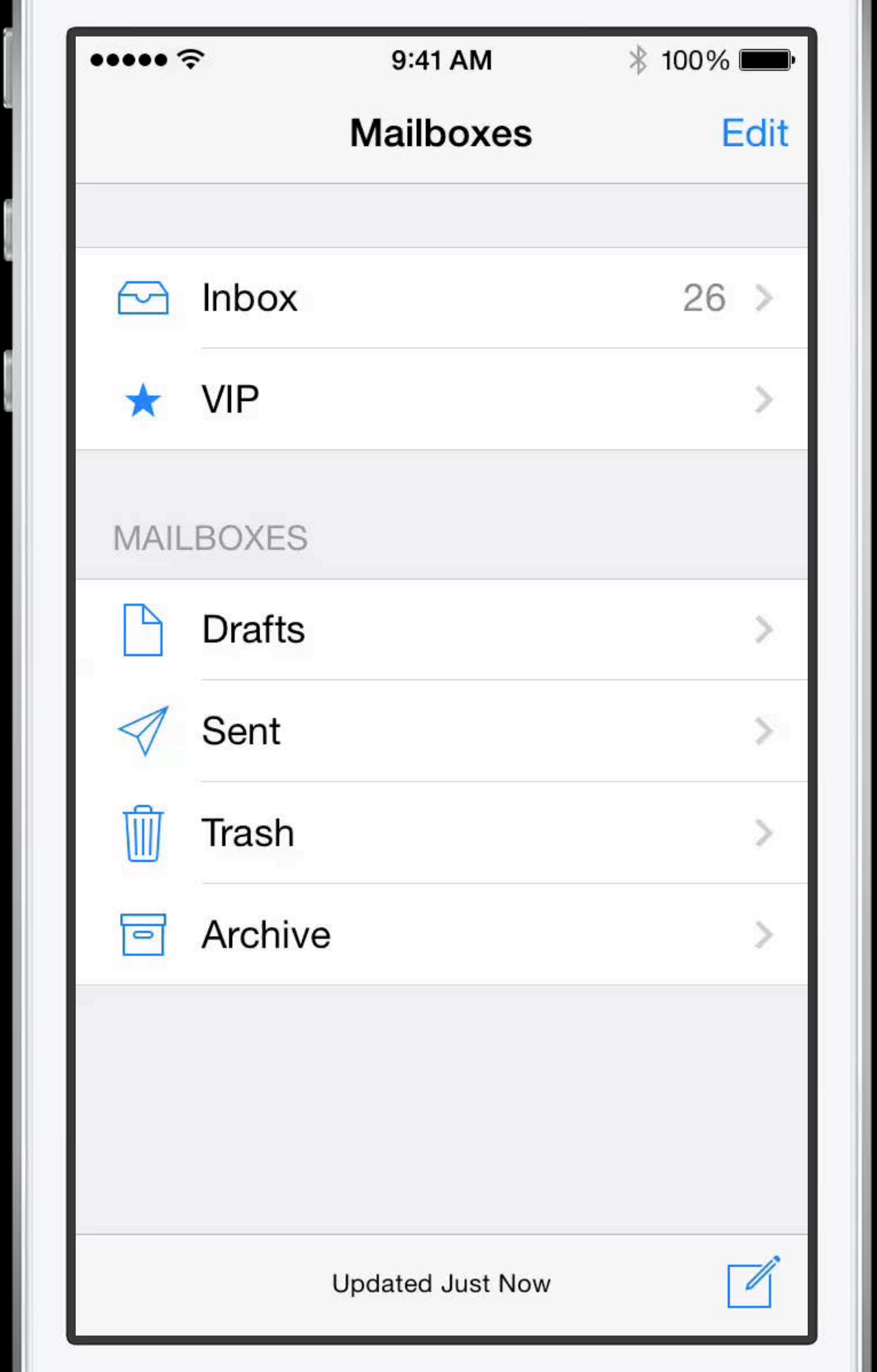
Drafts

Sent

Trash

Archive

Updated Just Now



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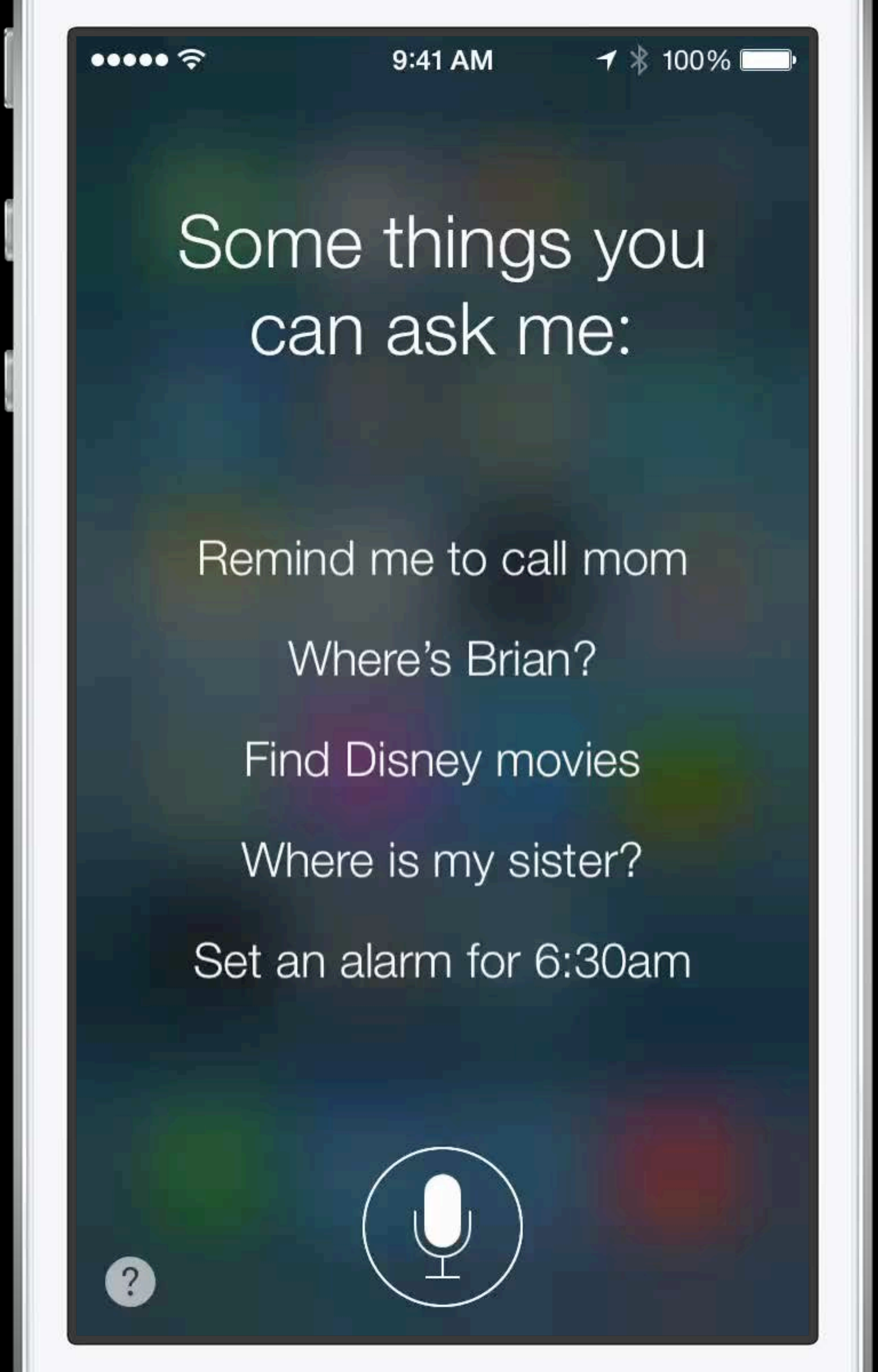

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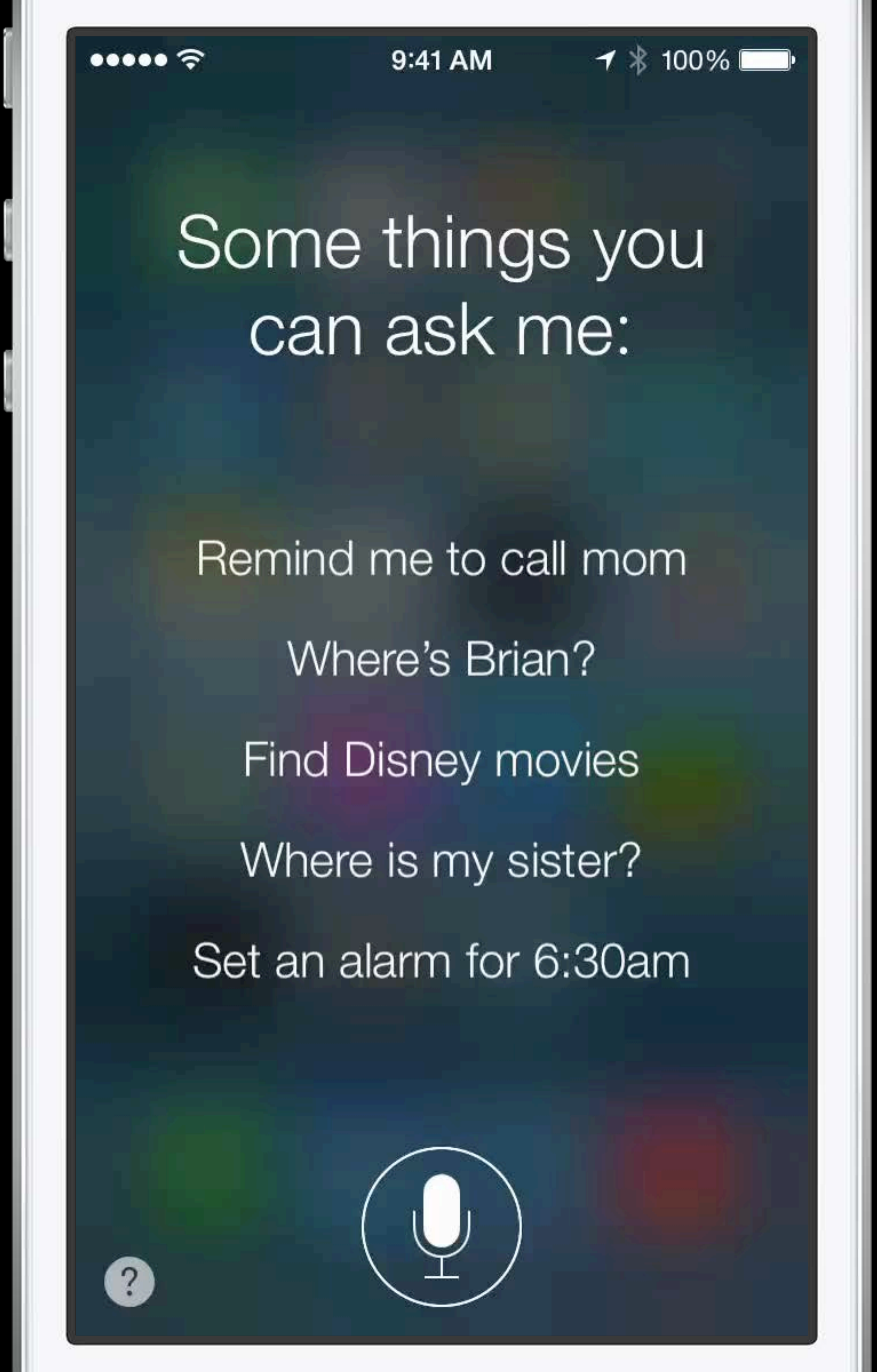

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Spring Animations

API

```
+ (void)animateWithDuration:(NSTimeInterval)duration
                      delay:(NSTimeInterval)delay
     usingSpringWithDamping:(CGFloat)dampingRatio
      initialSpringVelocity:(CGFloat)velocity
                    options:(UIViewAnimationOptions)options
                 animations:(void (^)(void))animations
                 completion:(void (^)(BOOL finished))completion
```

Spring Animations

API

```
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                      delay:(NSTimeInterval)delay
     usingSpringWithDamping:(CGFloat)dampingRatio
      initialSpringVelocity:(CGFloat)velocity
                    options:(UIViewAnimationOptions)options
                 animations:(void (^)(void))animations
                 completion:(void (^)(BOOL finished))completion
```
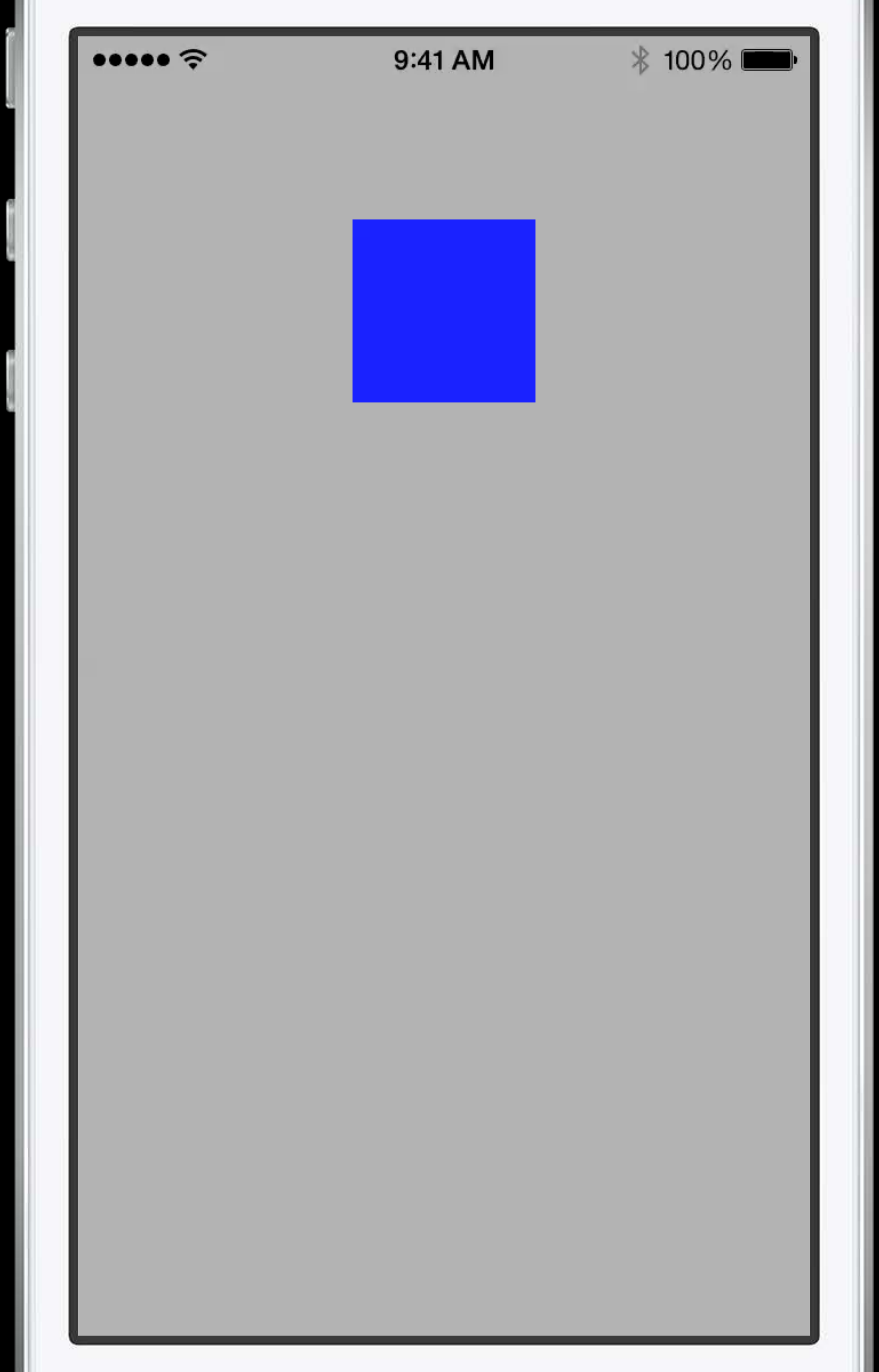
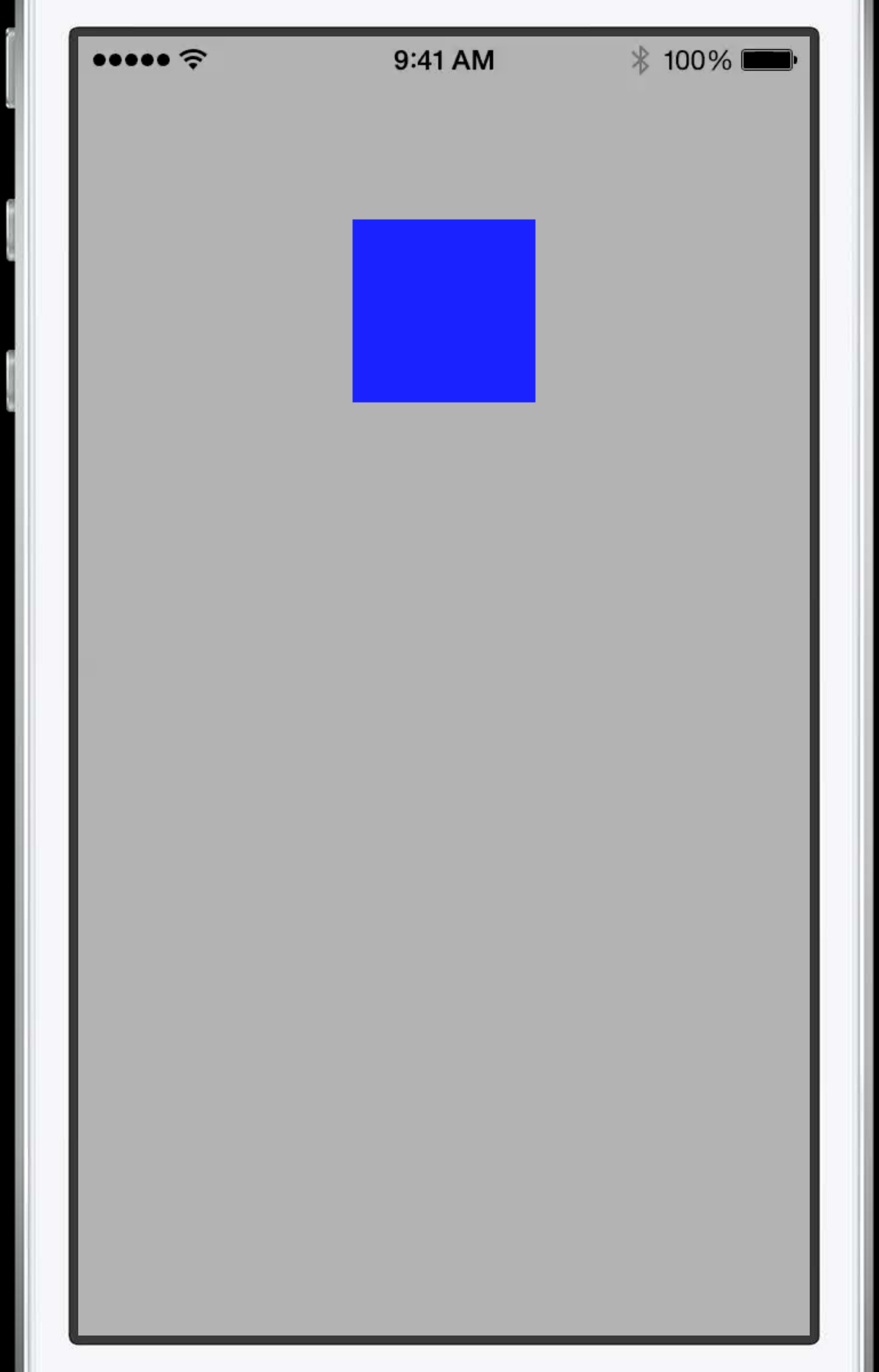
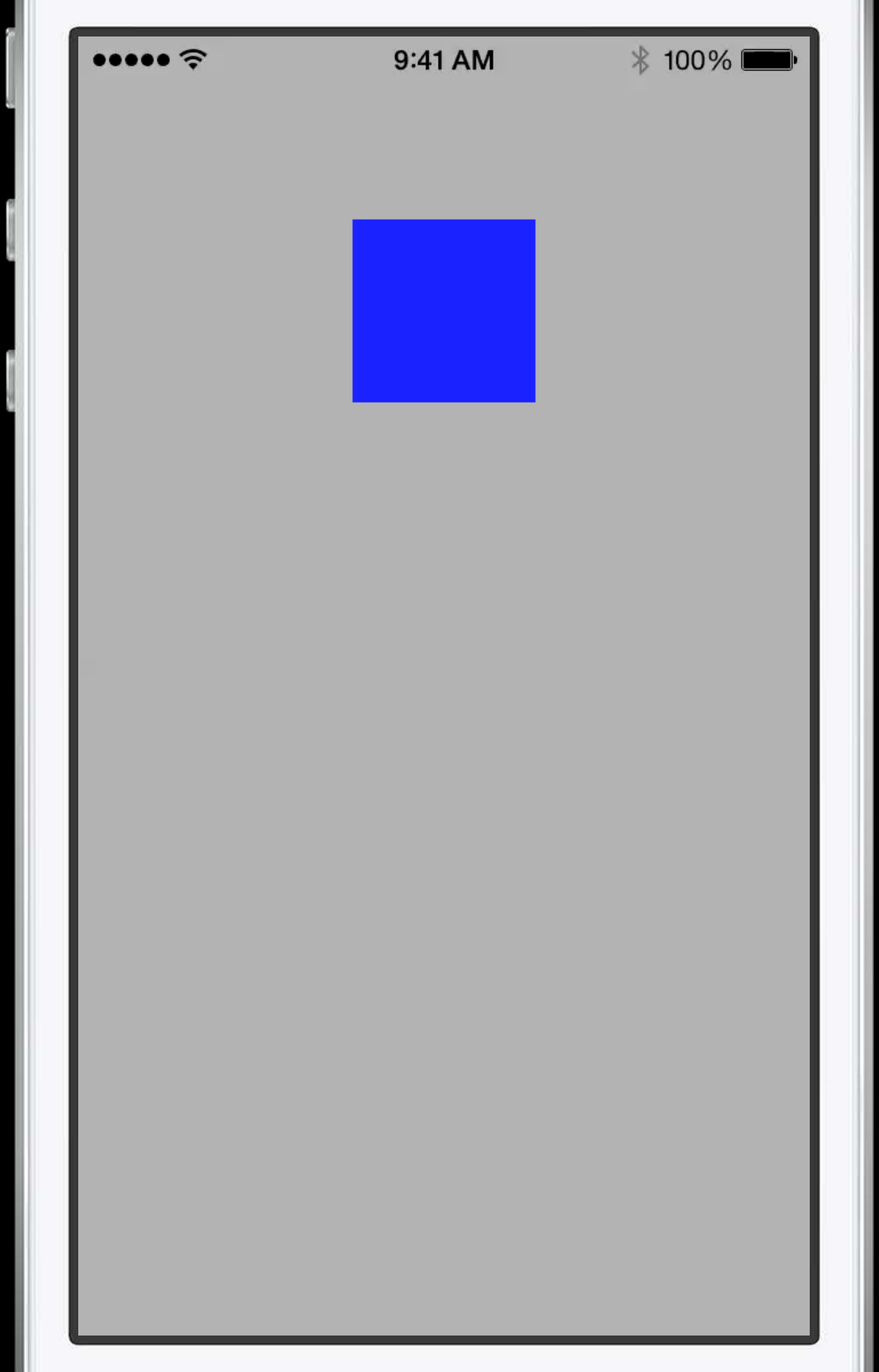



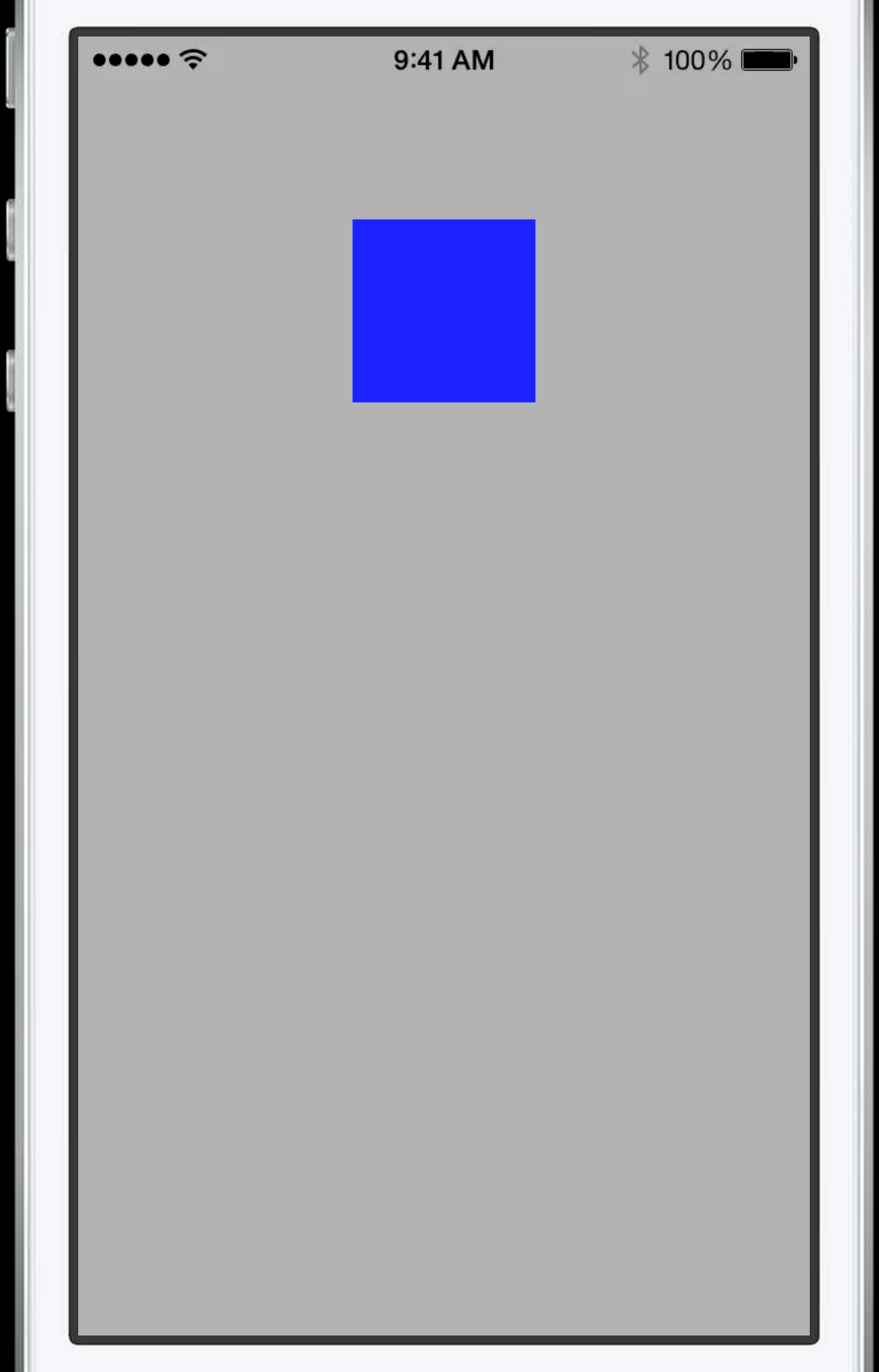
damping = 0.1



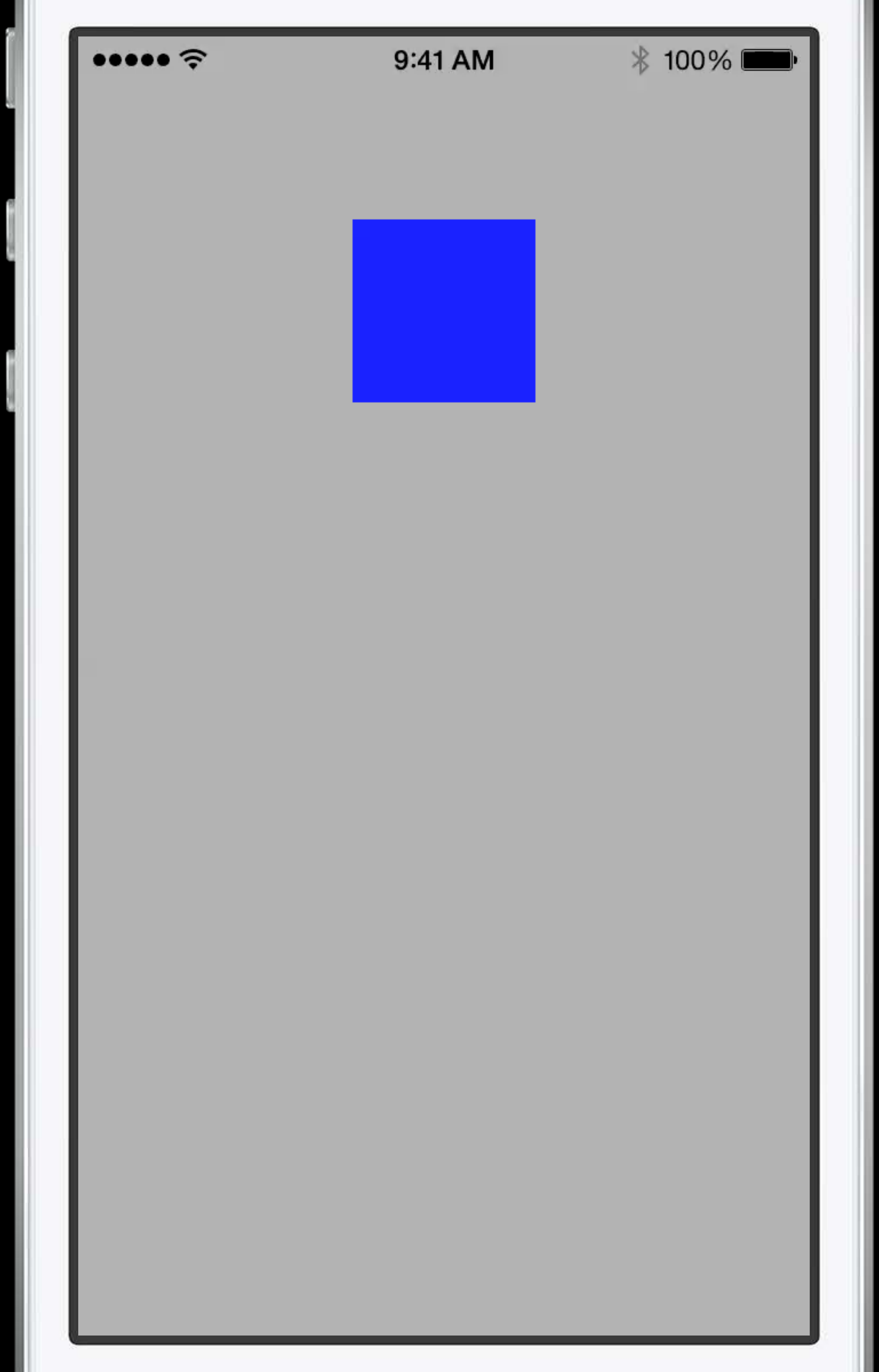
```
damping = 0.1
```



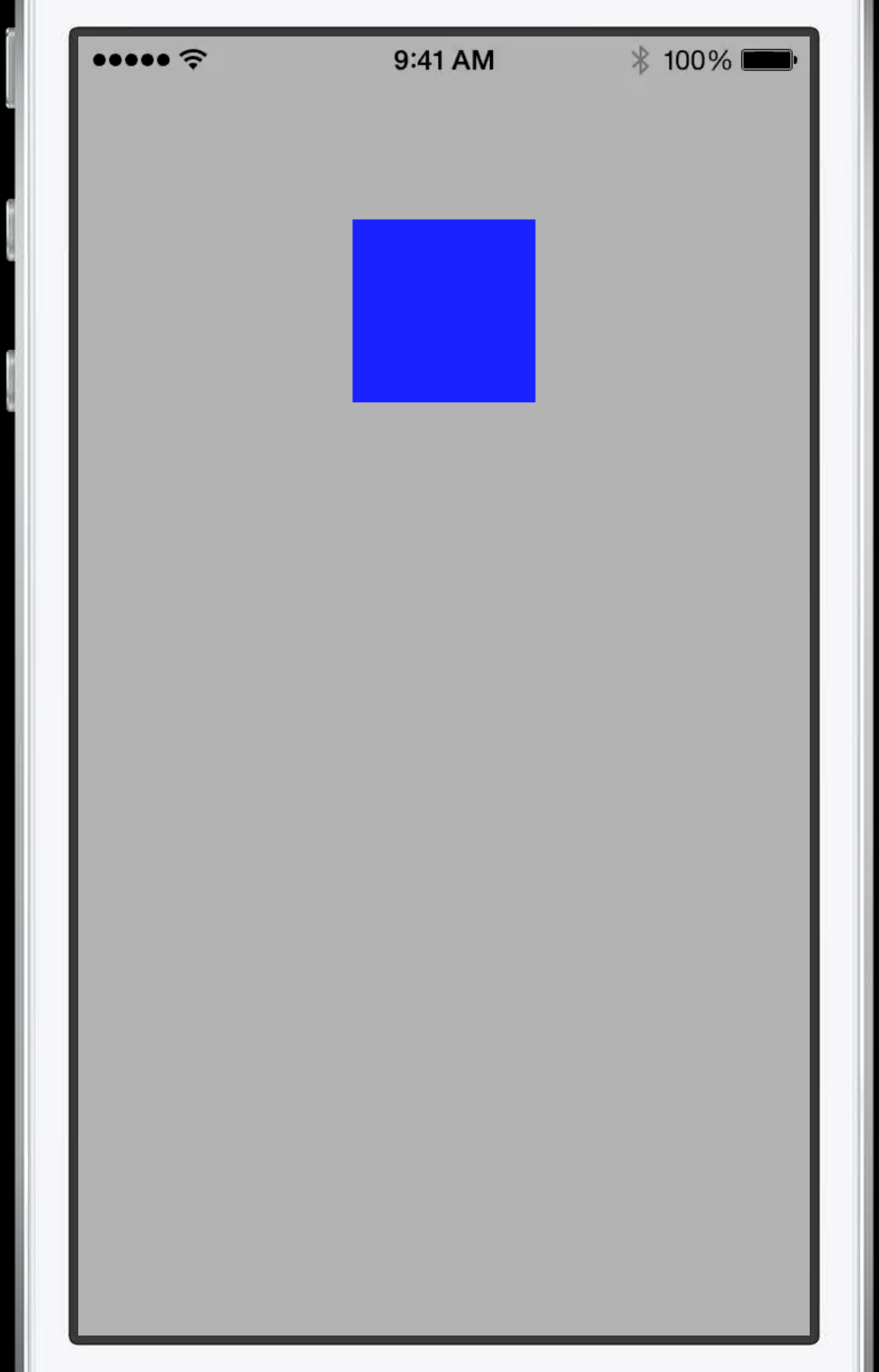
```
damping = 0.5
```



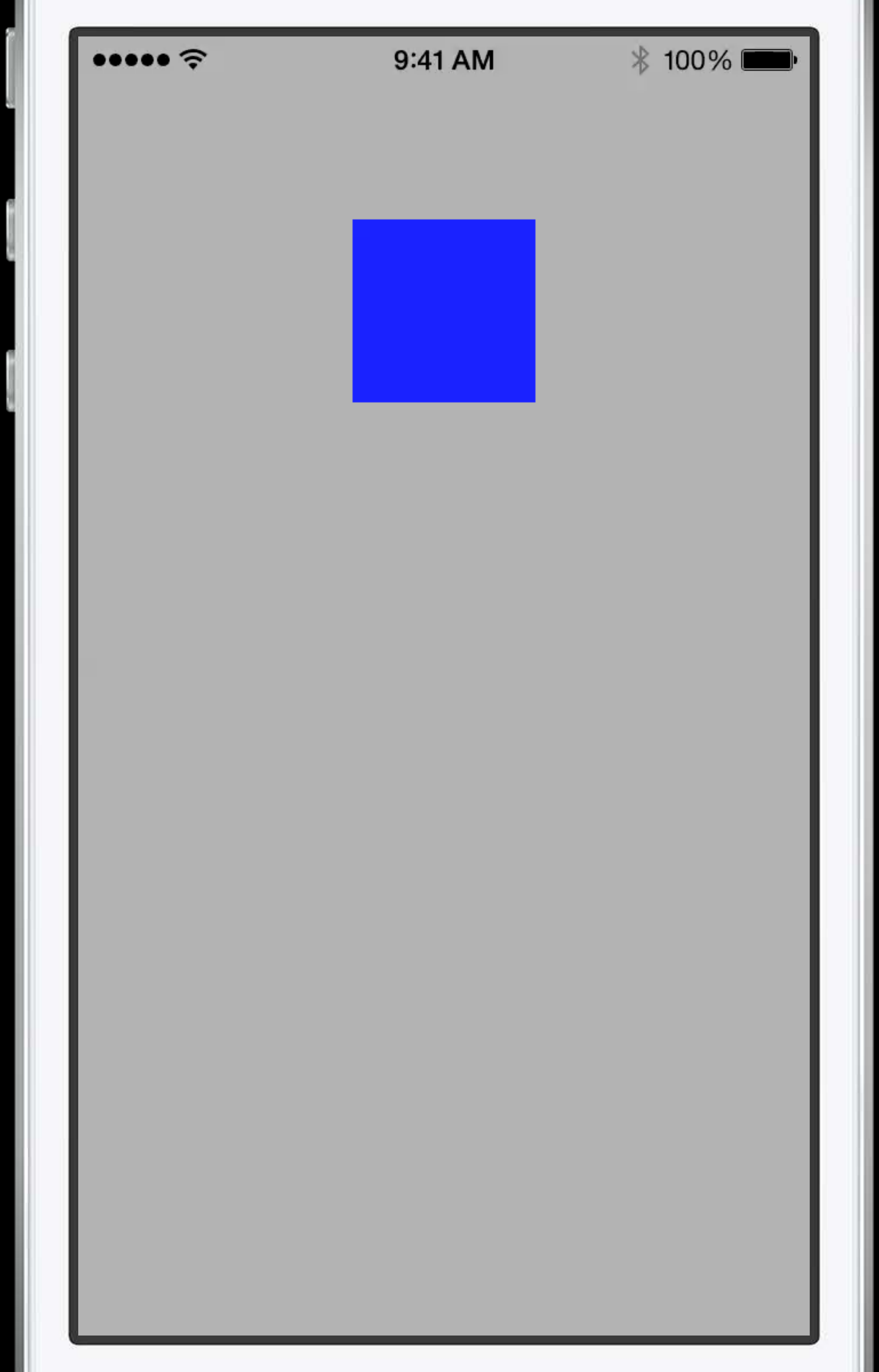
`damping = 0.5`



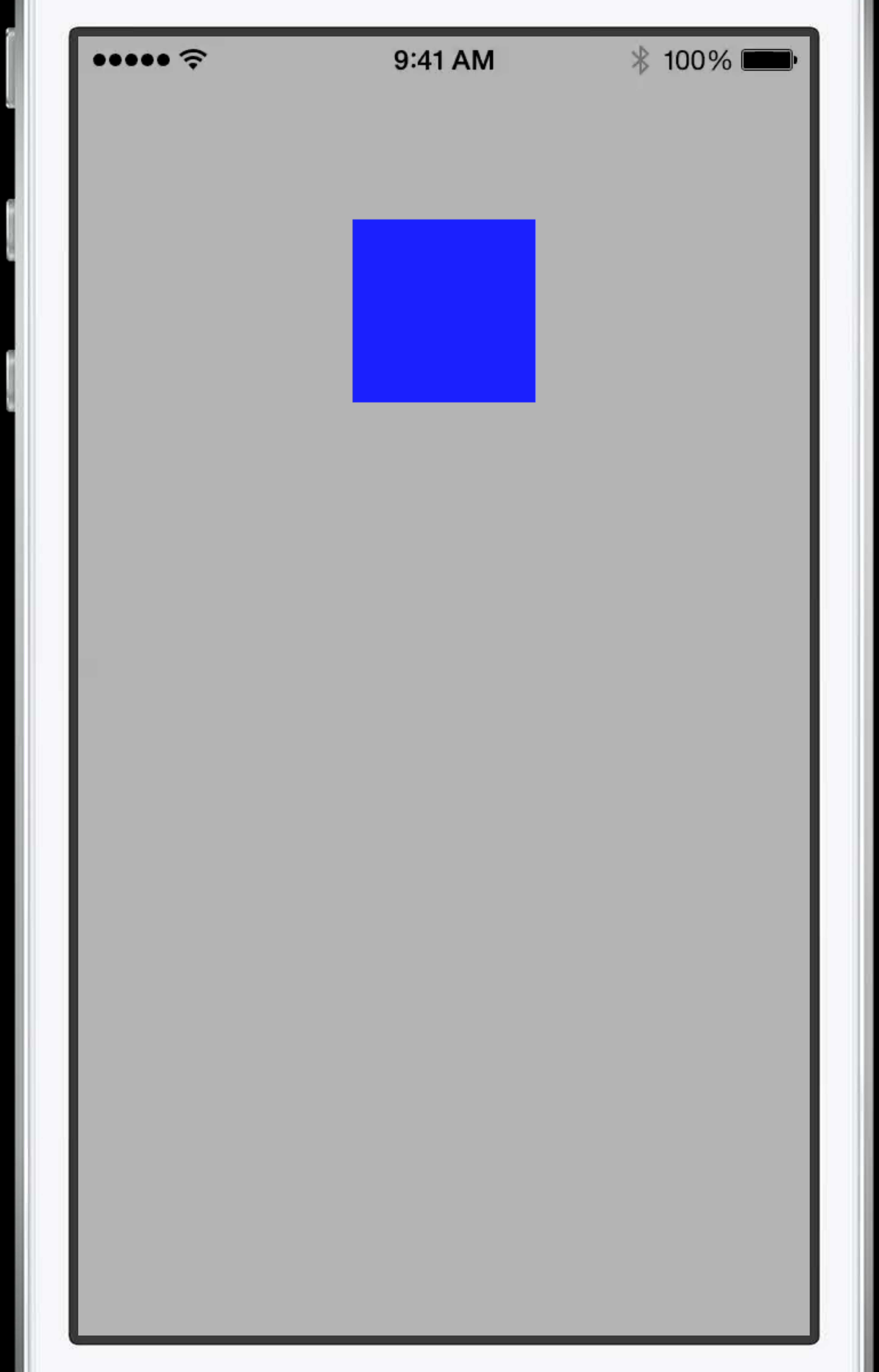
```
damping = 0.8
```



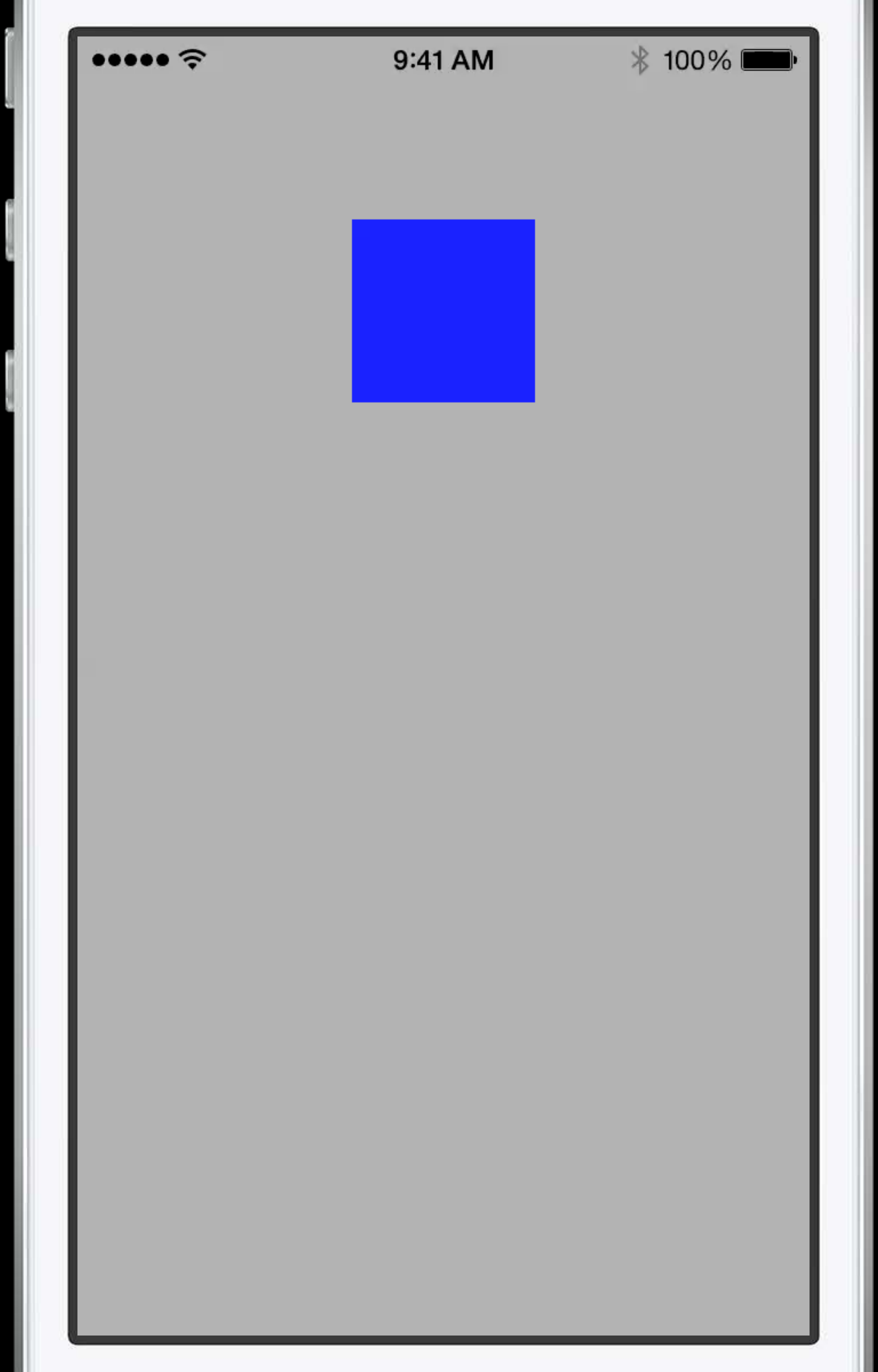
```
damping = 0.8
```



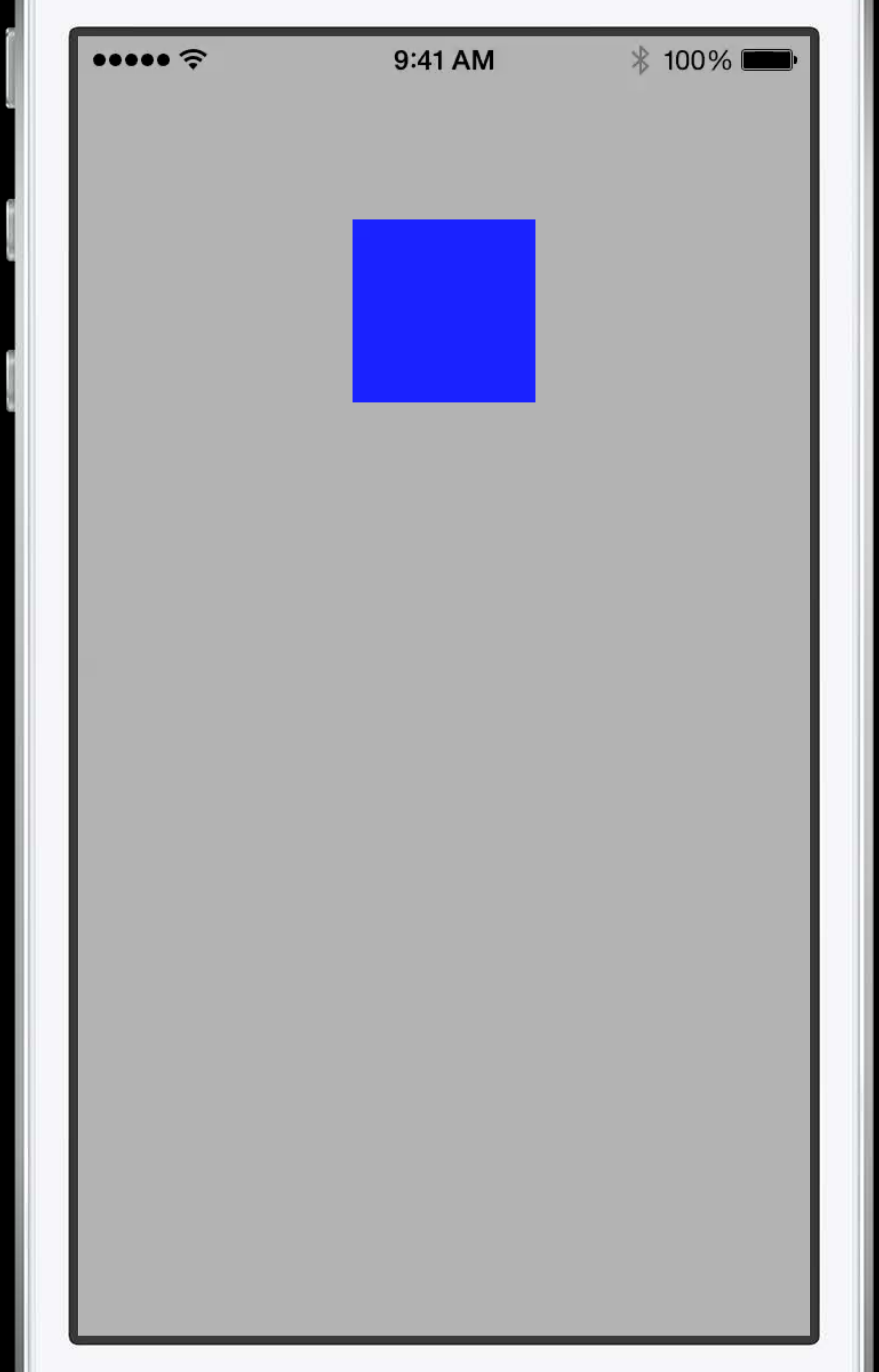
```
damping = 1.0
```



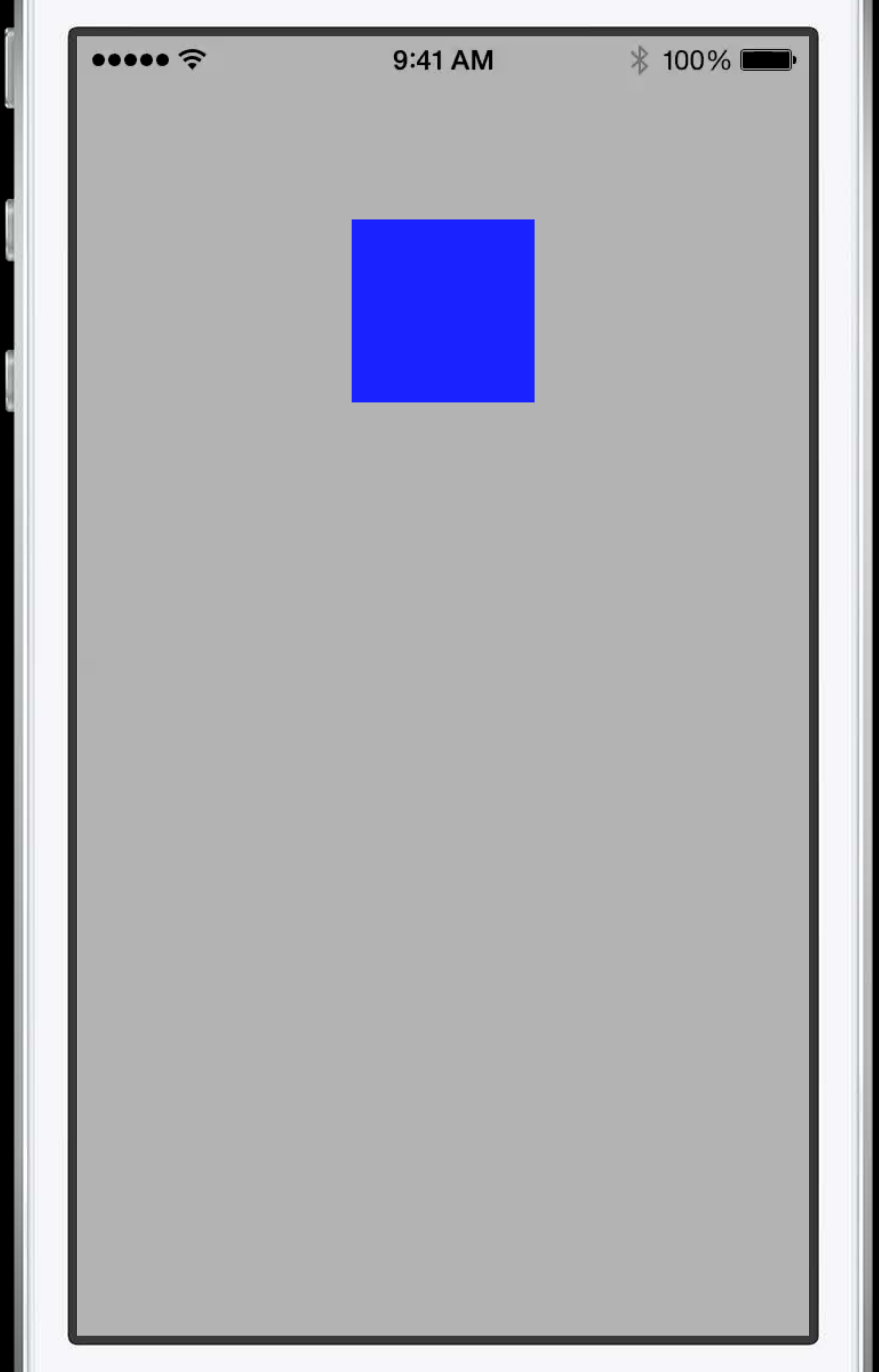
```
damping = 1.0
```



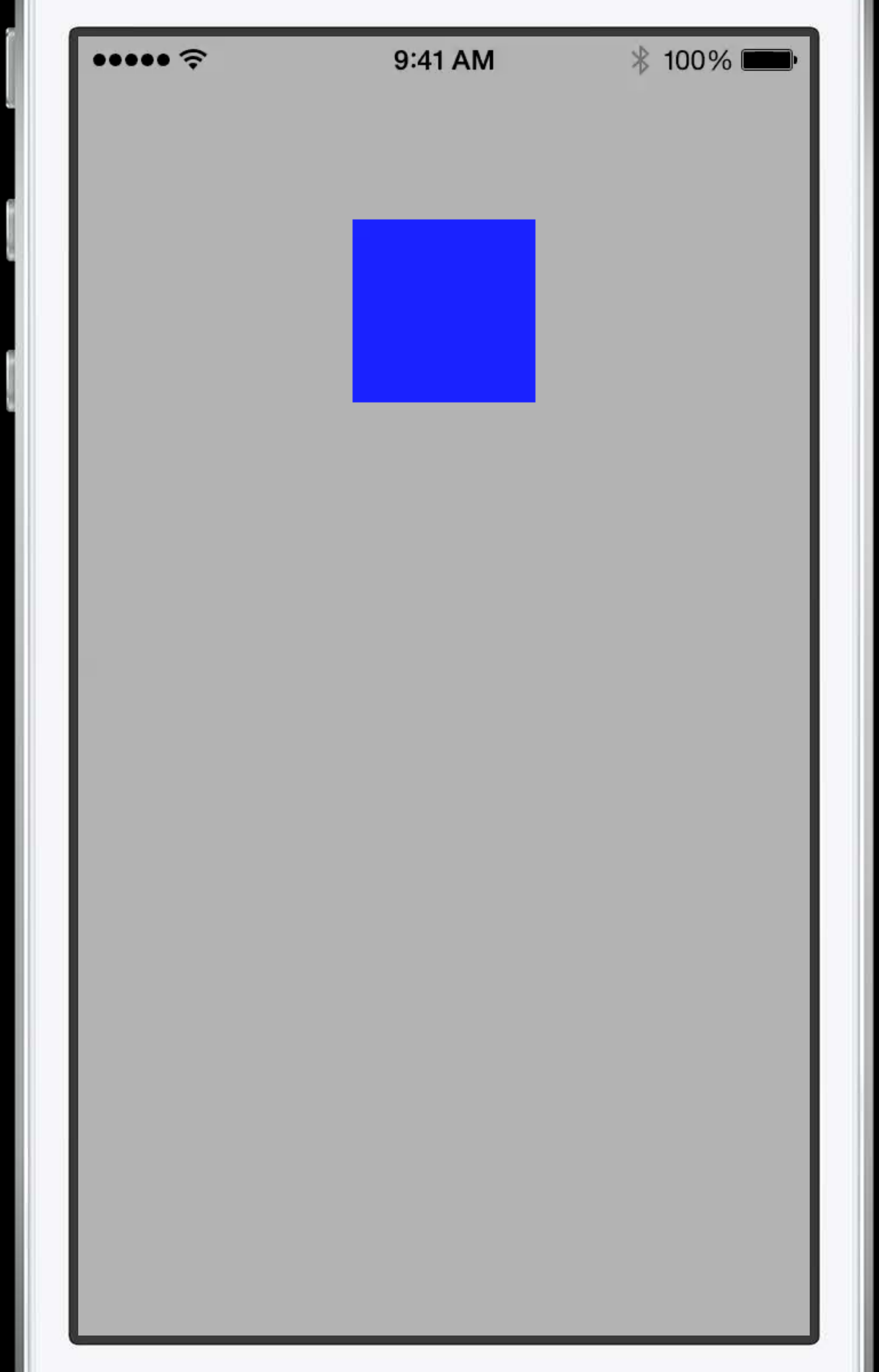
damping = 1.0
initialVelocity = 20.0



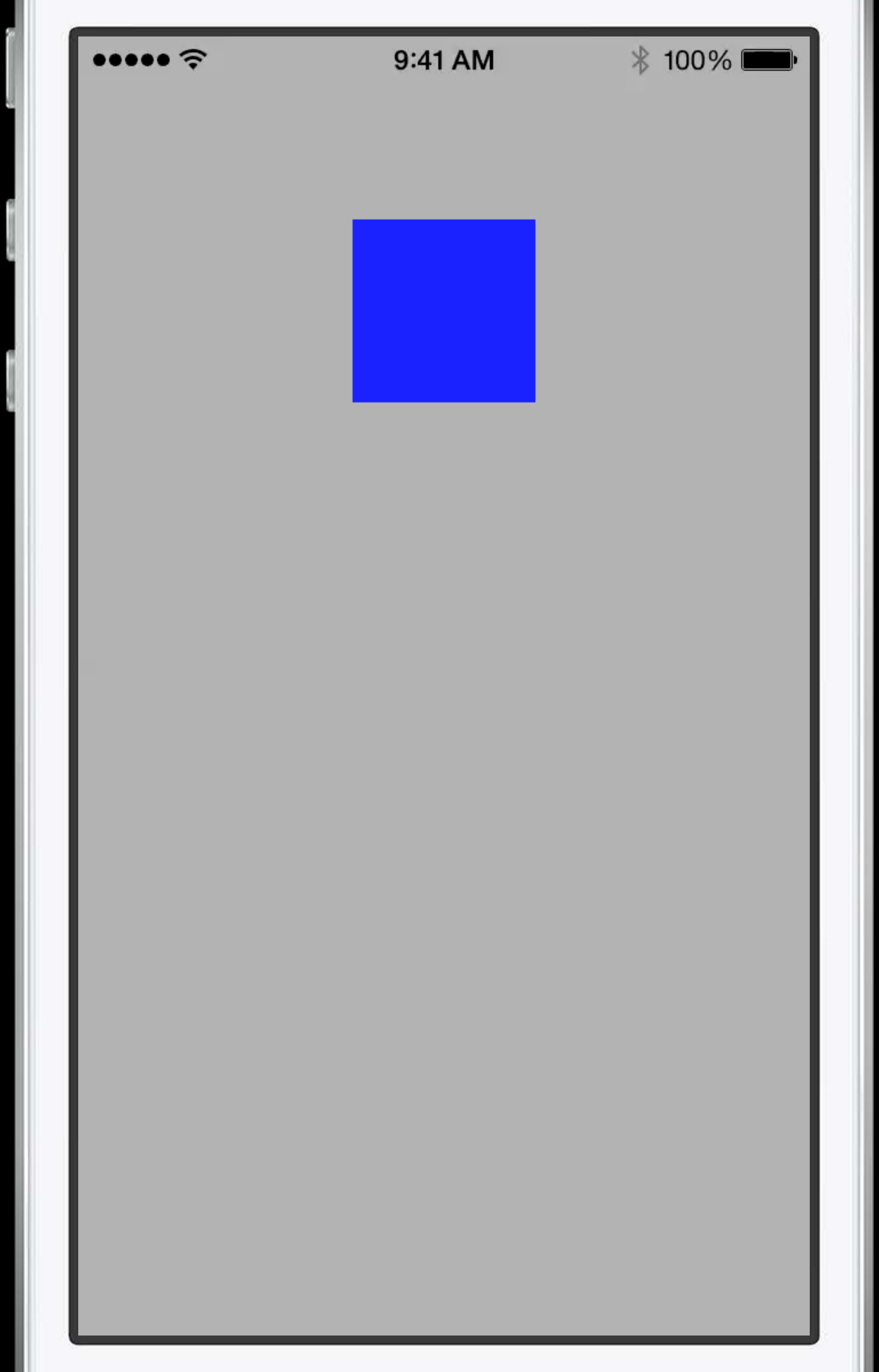
```
damping = 1.0
initialVelocity = 20.0
```



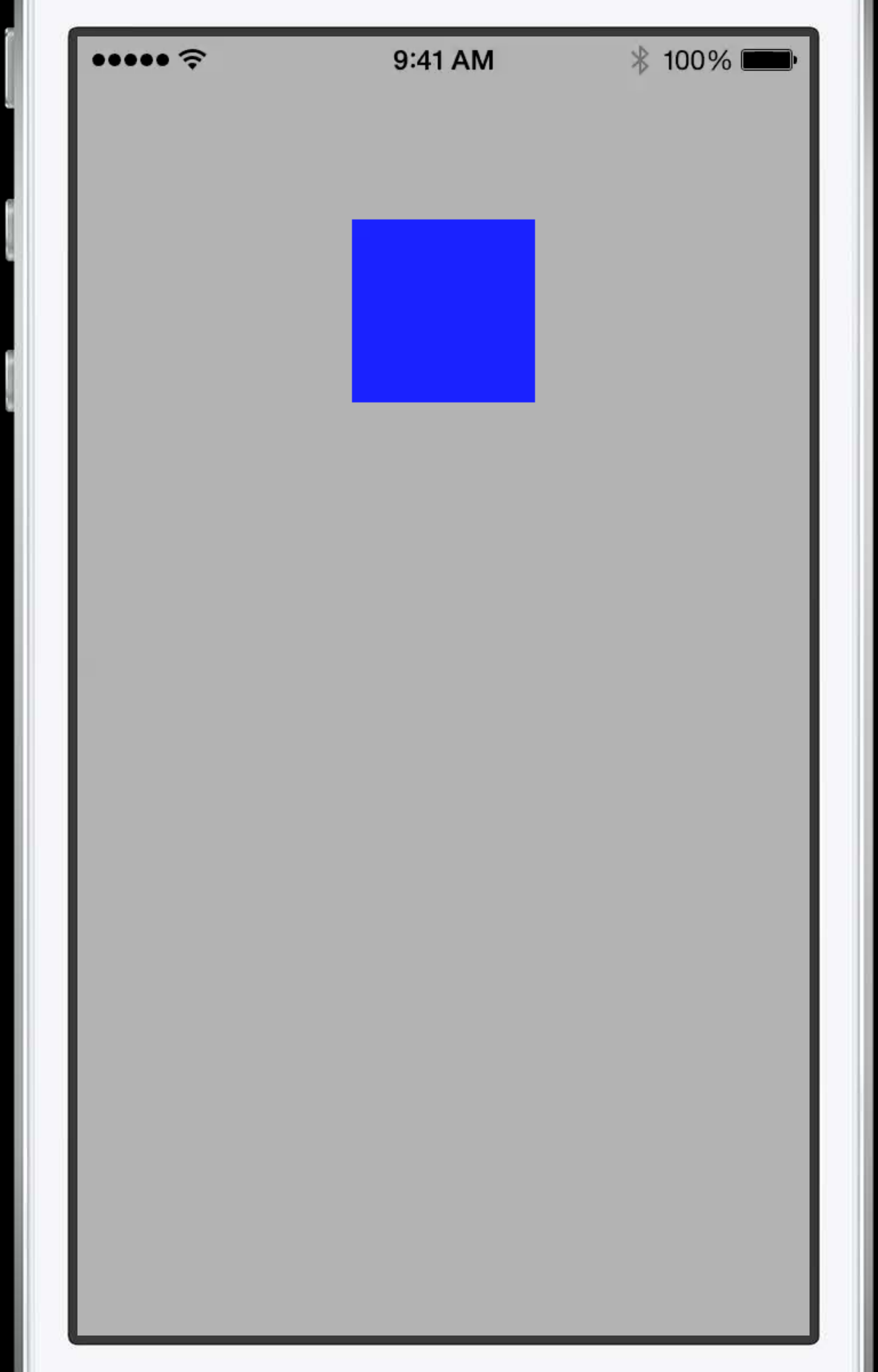
```
damping = 1.0
initialVelocity = 40.0
```



```
damping = 1.0
initialVelocity = 40.0
```



```
damping = 0.2
initialVelocity = 15.0
```



```
damping = 0.2
initialVelocity = 15.0
```

Spring Animations

Where might you use them?

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Great substitute for linear animations

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Any place you want to fit in with native UIKit controls

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Make controls feel more natural

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Any place you want to fit in with native UIKit controls

Used for nearly all animations in iOS

Make controls feel more natural

Applies to any animatable property, not just position

Demo

Spring animations

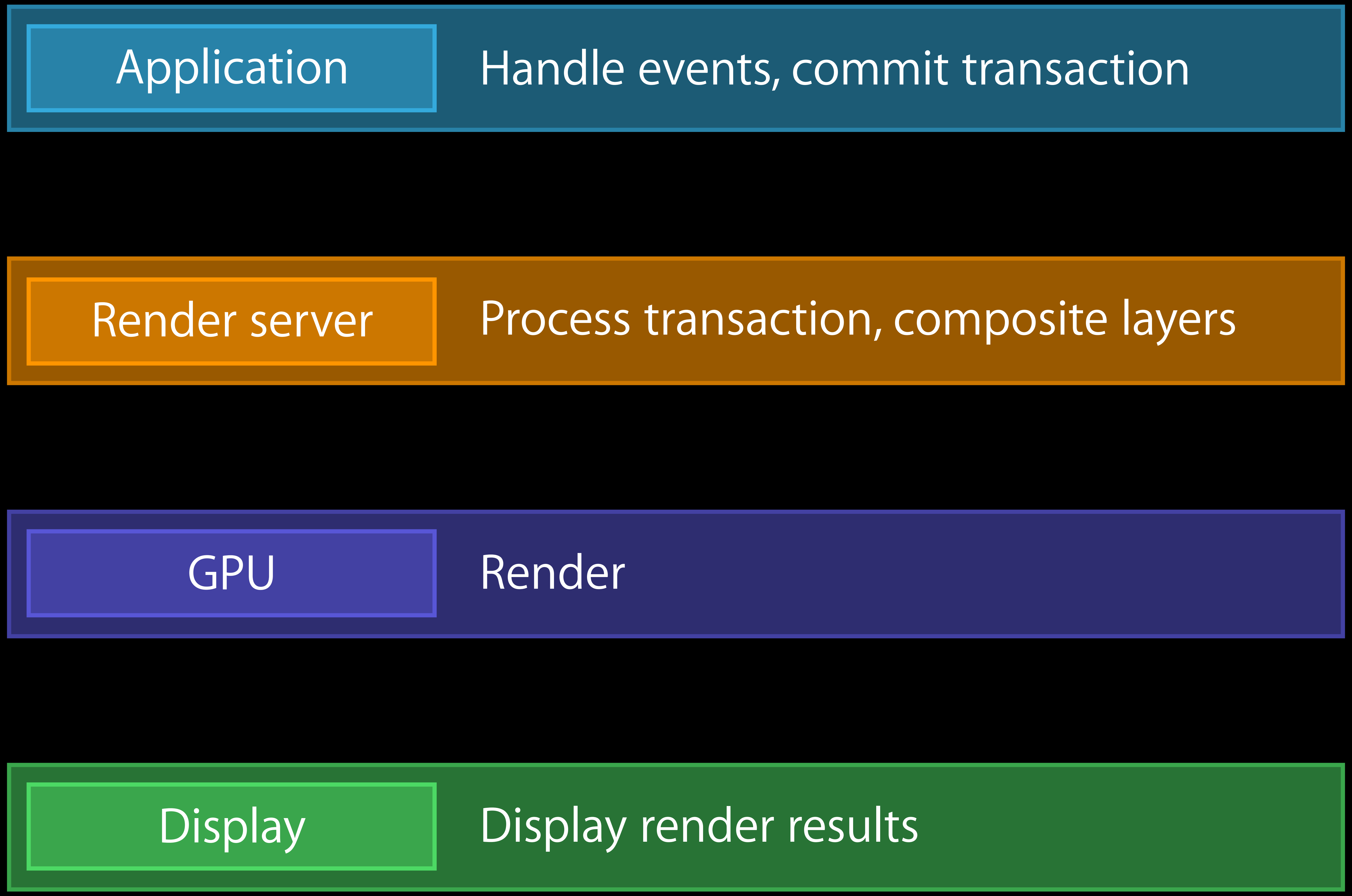
UIVisualEffectView

Ask and ye shall receive

Rendering in iOS

A brief aside

Rendering Pipeline



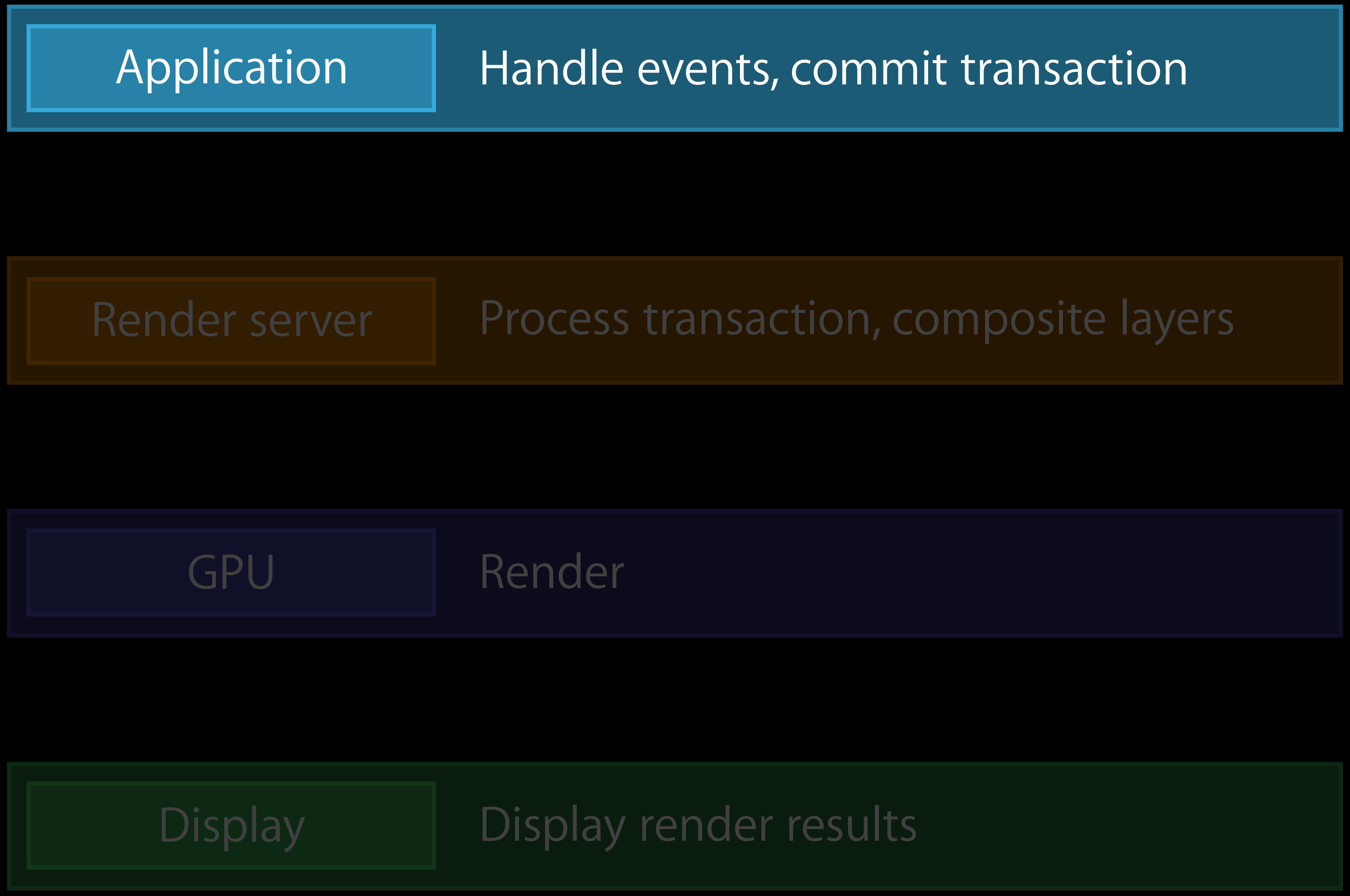
Application — Handle events, commit transaction

Render server — Process transaction, composite layers

GPU — Render

Display — Display render results

Rendering Pipeline



Application — Handle events, commit transaction

Render server — Process transaction, composite layers

GPU — Render

Display — Display render results

Commit Transaction

In your app

Commit Transaction

In your app

Set up and perform view layout

Commit Transaction

In your app

- Set up and perform view layout
- View and string drawing

Commit Transaction

In your app

- Set up and perform view layout
- View and string drawing
- Additional Core Animation work

Commit Transaction

In your app

Set up and perform view layout

View and string drawing

Additional Core Animation work

Package up layers and send them to render server

Commit Transaction

In your app

Set up and perform view layout

View and string drawing

Additional Core Animation work

Package up layers and send them to render server

● Advanced Graphics and Animations in iOS Apps	Russian Hill	Tuesday 10:15AM

UIVisualEffectView

Ask and ye shall receive

Fast, Static Blur

drawViewHierarchyInRect:afterScreenUpdates:

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Last year presented a technique for blur effects

● Implementing Engaging UI on iOS 7 WWDC 2013

Fast, Static Blur

drawViewHierarchyInRect:afterScreenUpdates:

Last year presented a technique for blur effects

Recommended if blurred content doesn’t need to change

Fast, Static Blur

drawViewHierarchyInRect:afterScreenUpdates:

Last year presented a technique for blur effects

Recommended if blurred content doesn’t need to change

Highly optimized

UIVisualEffectView

Intro

NEW

UIVisualEffectView

Intro

NEW

New API for creating visual effects

UIVisualEffectView

Intro

NEW

New API for creating visual effects

Two effect types

UIVisualEffectView

Intro

NEW

New API for creating visual effects

Two effect types

- Live blur

UIVisualEffectView

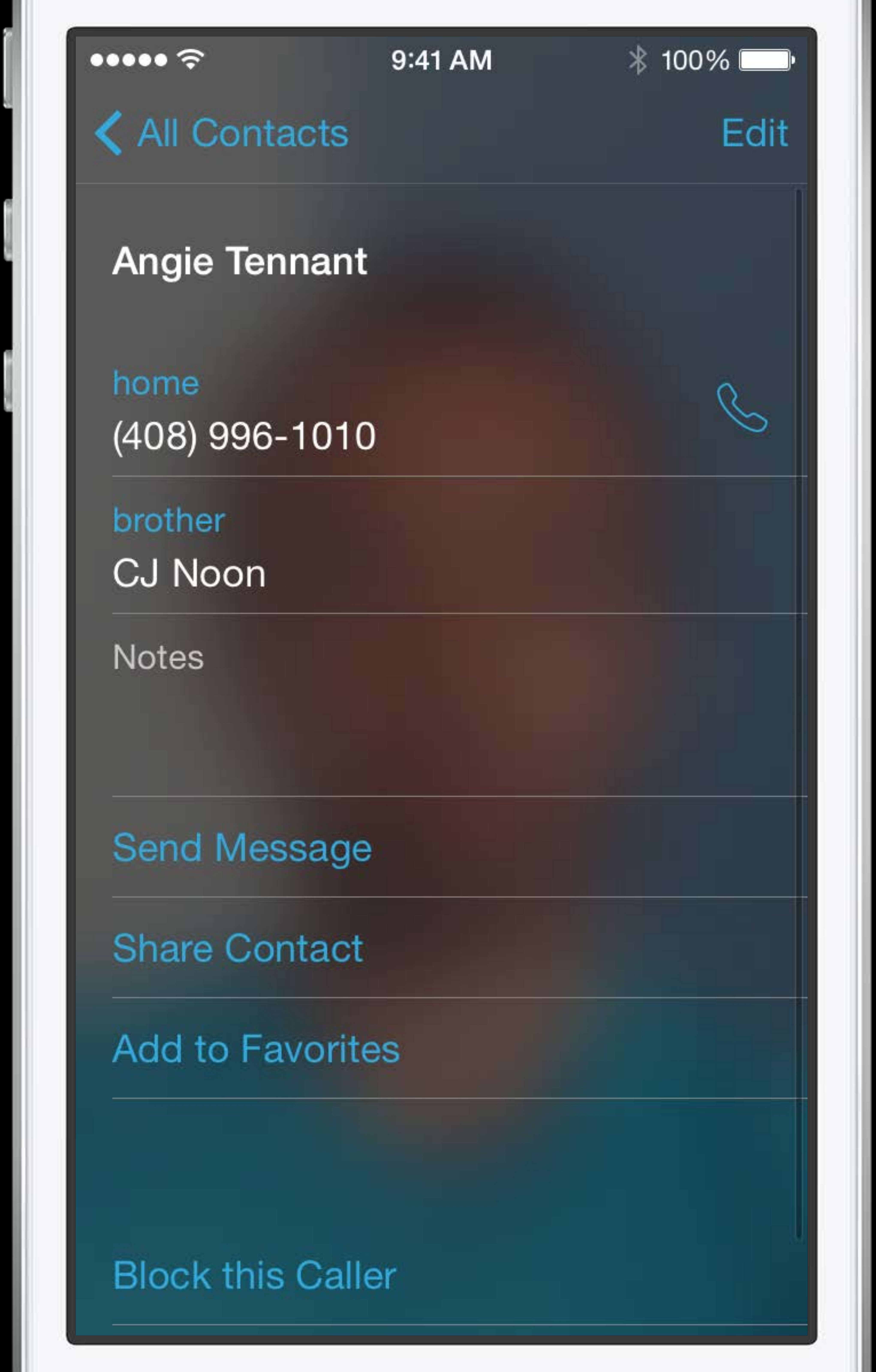
Intro

NEW

New API for creating visual effects

Two effect types

- Live blur
- Vibrancy

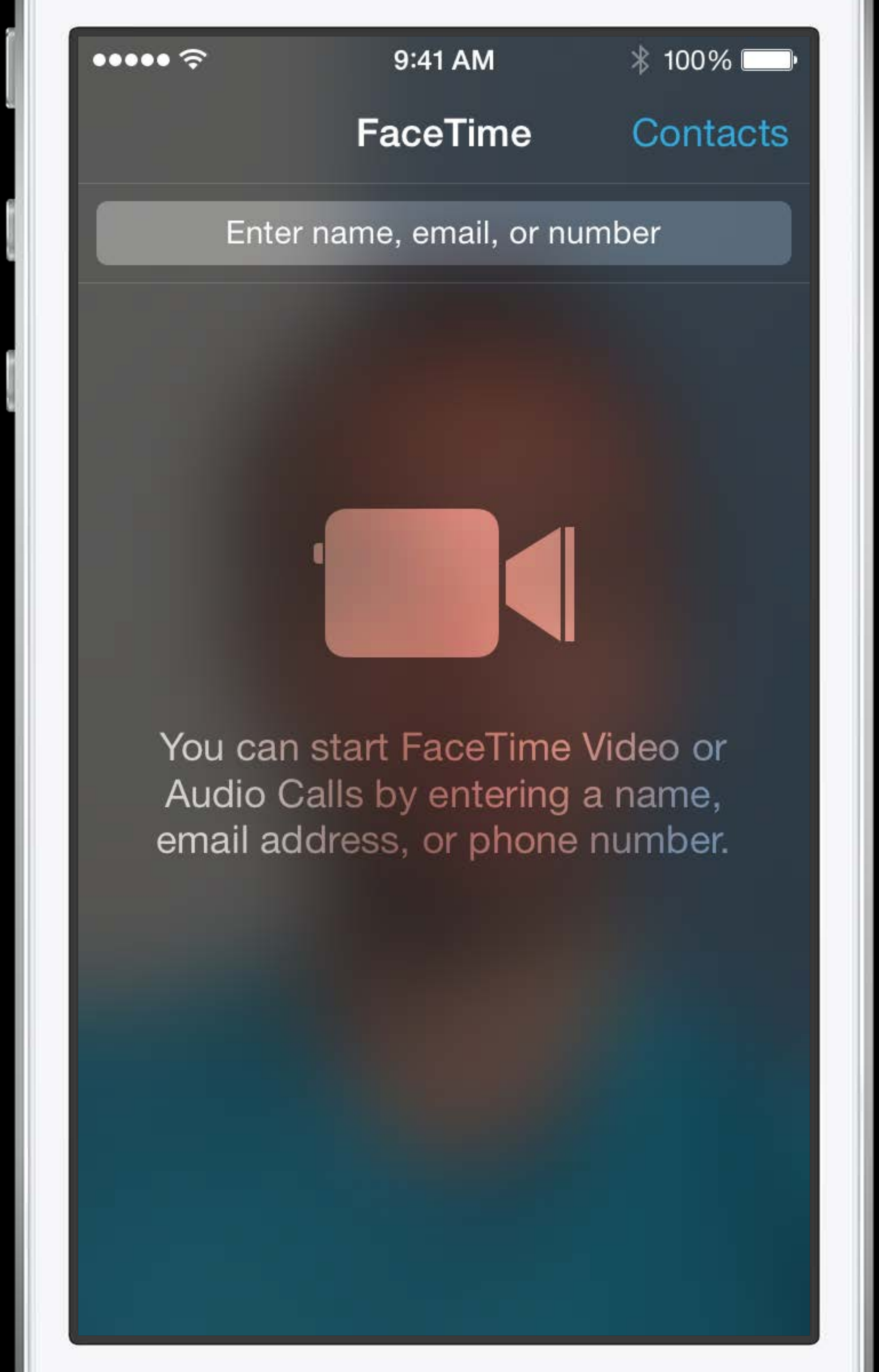


Angie Tennant

home
(408) 996-1010

brother
CJ Noon

Notes



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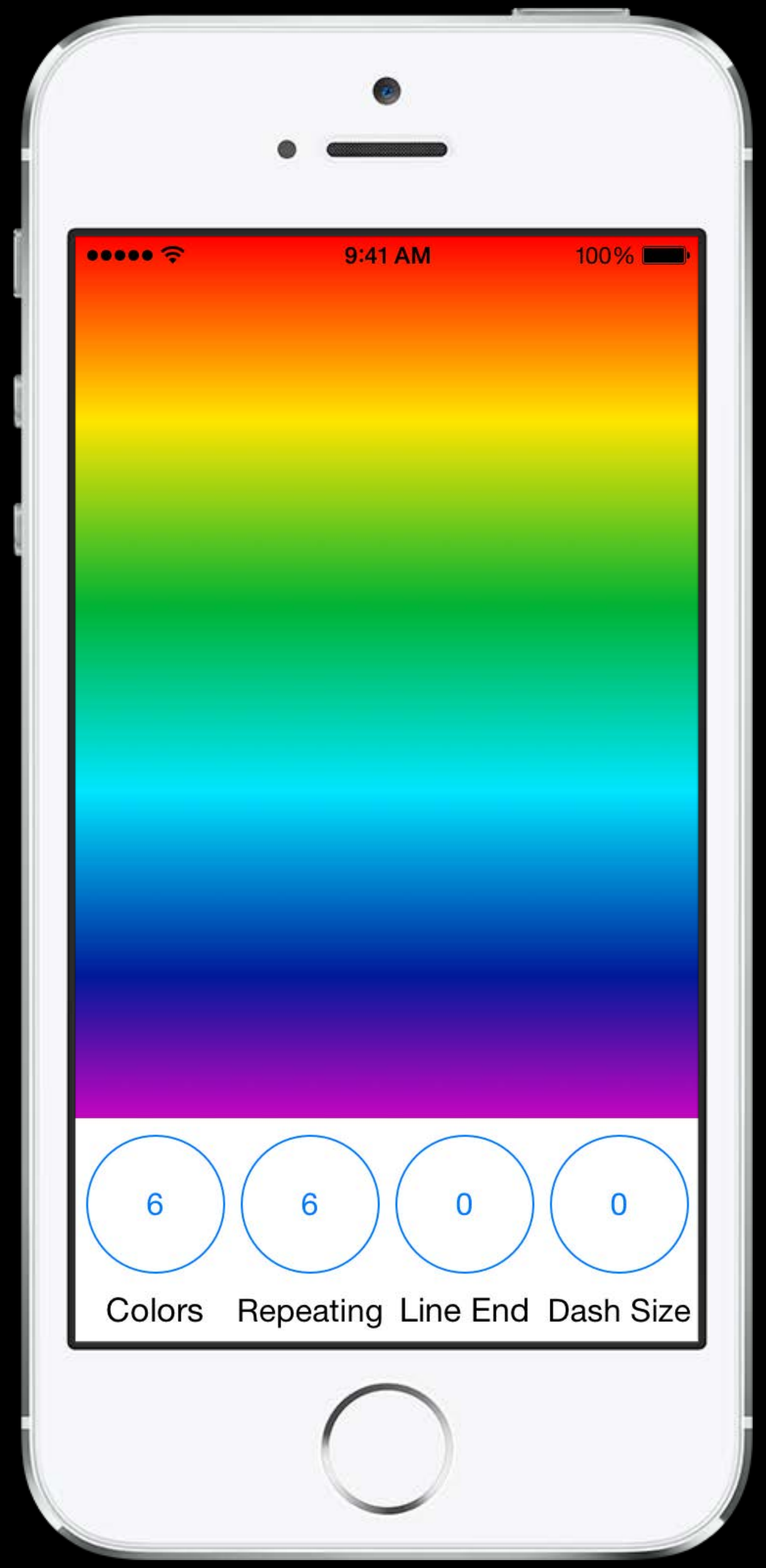
UIVisualEffectView

UIBlurEffect

NEW

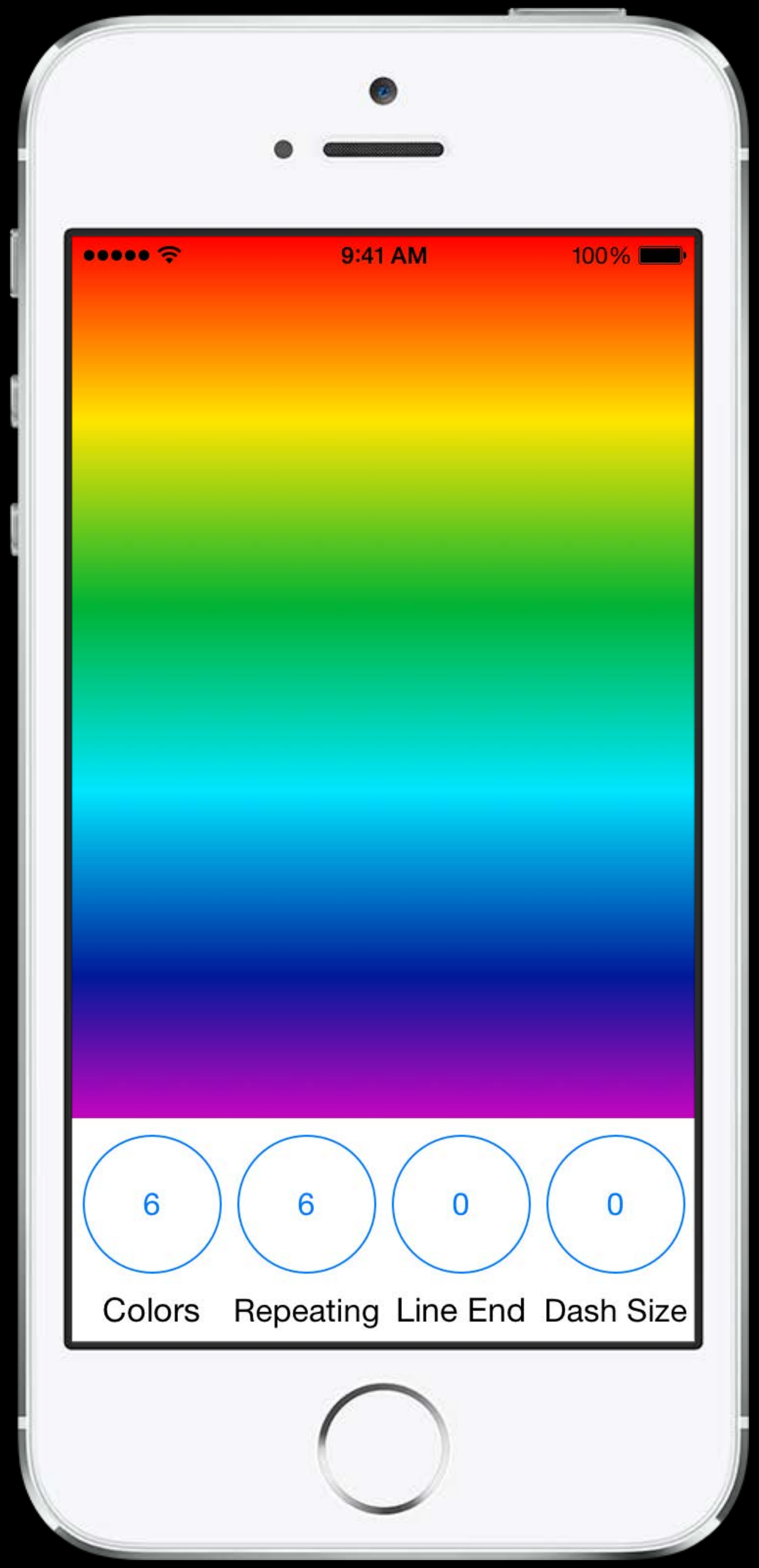


UIVisualEffectView

UIBlurEffect

NEW

Three styles



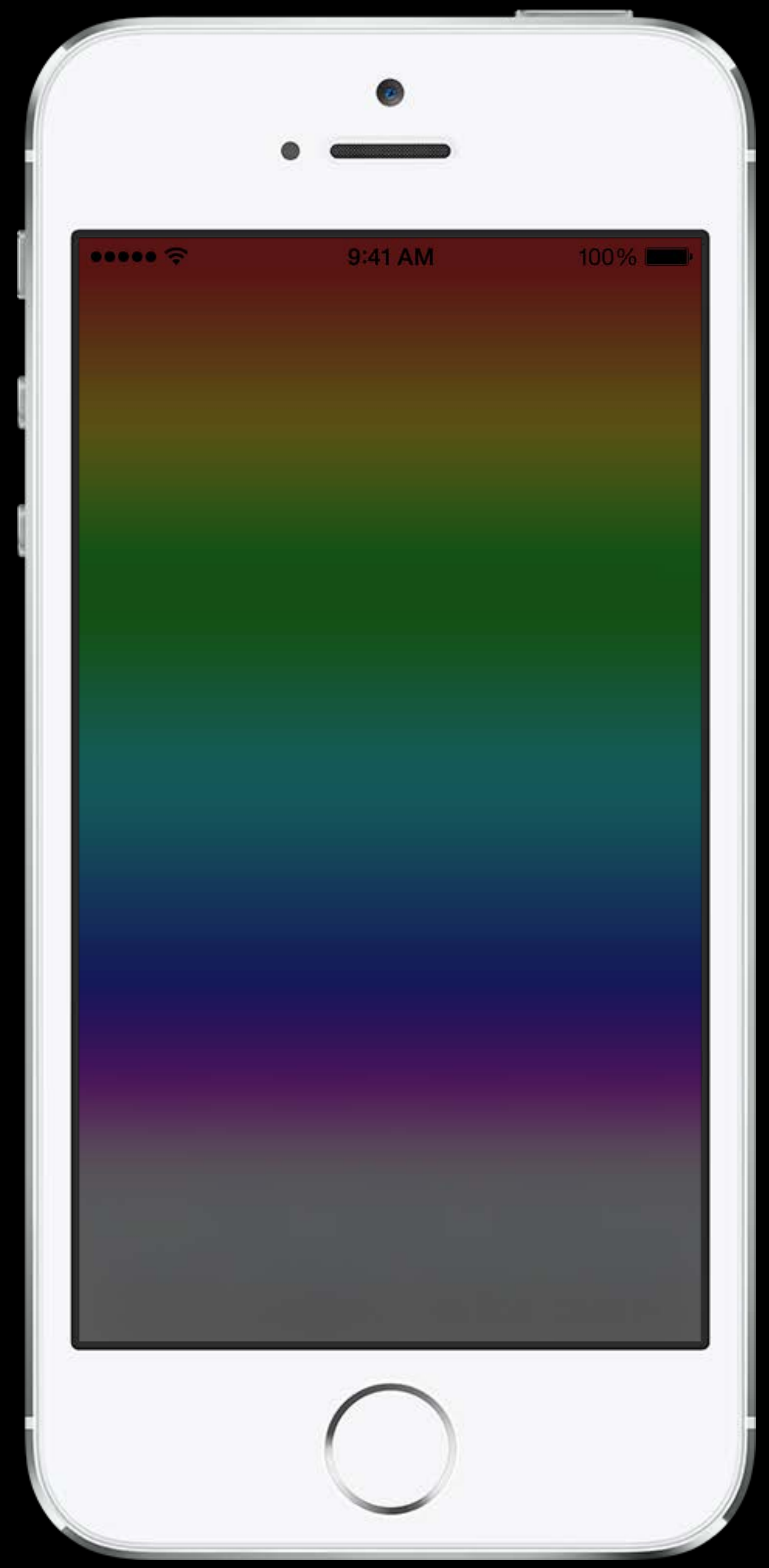
UIVisualEffectView

UIBlurEffect

NEW

Three styles

- Dark



UIVisualEffectView

UIBlurEffect

NEW

Three styles

- Dark
- Light

UIVisualEffectView

UIBlurEffect

NEW

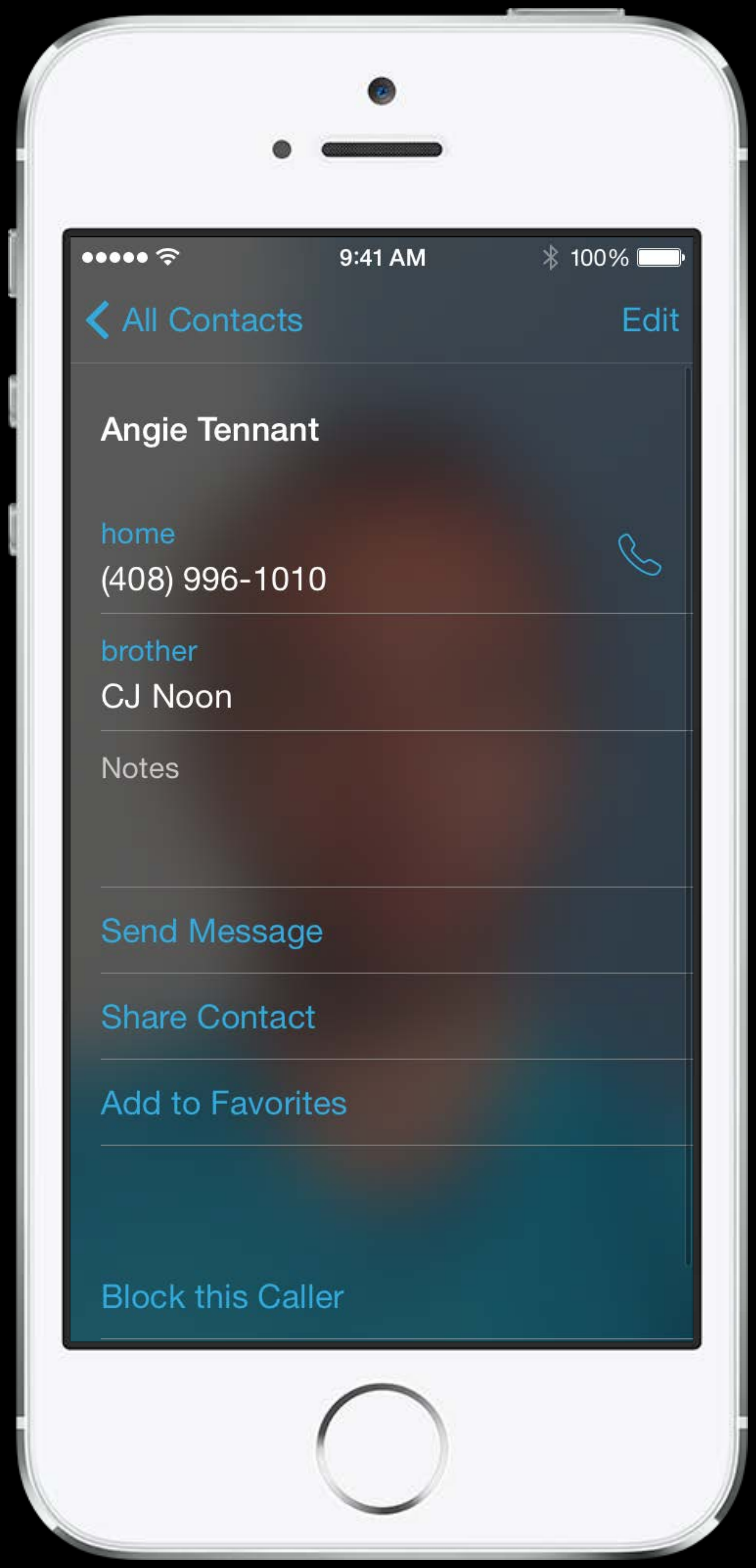
Three styles

- Dark
- Light
- ExtraLight

UIVisualEffectView

UIBlurEffect

NEW



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All Contacts Edit

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Notes

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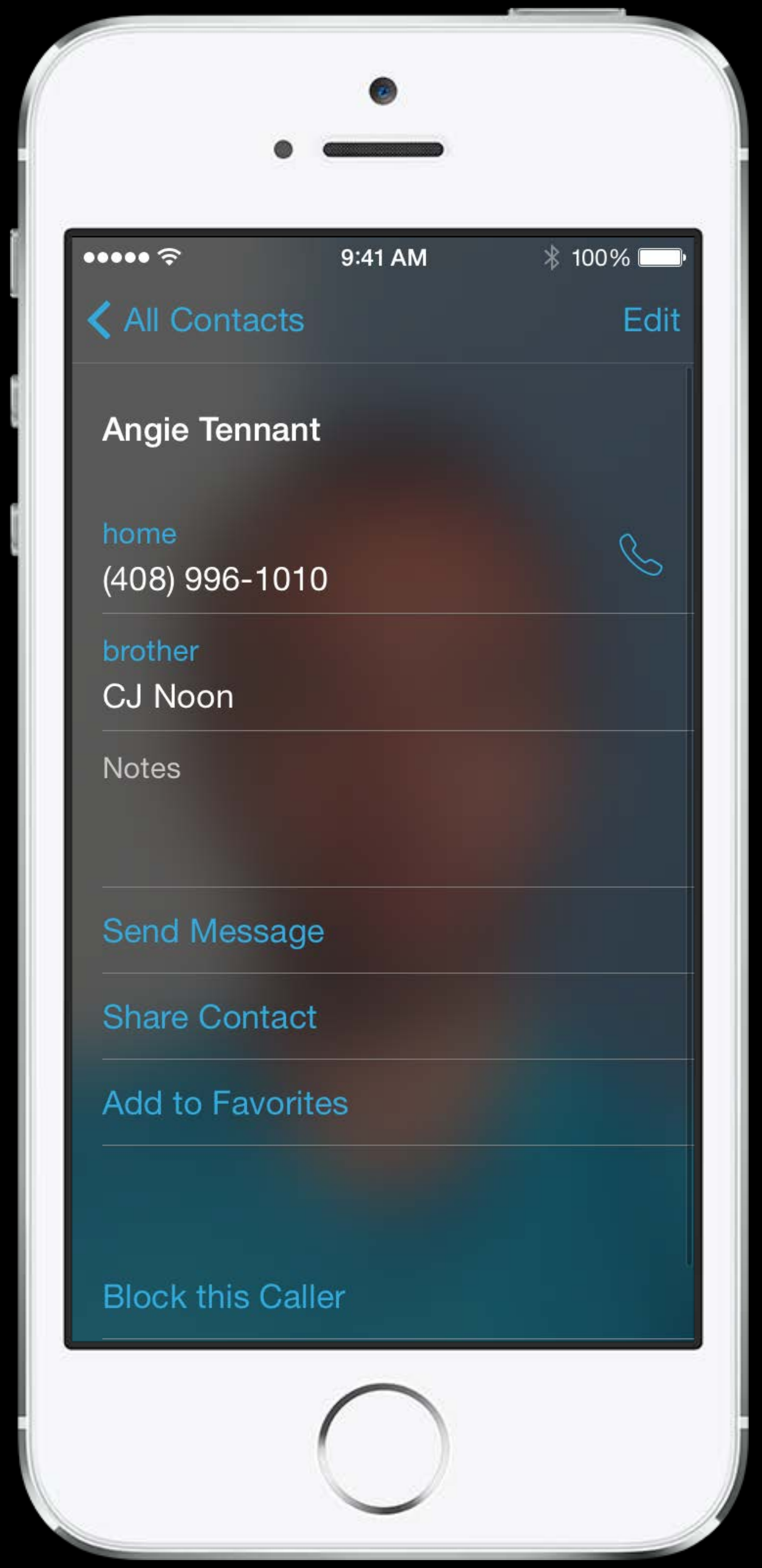
UIVisualEffectView

UIBlurEffect

NEW

More than a simple Gaussian blur



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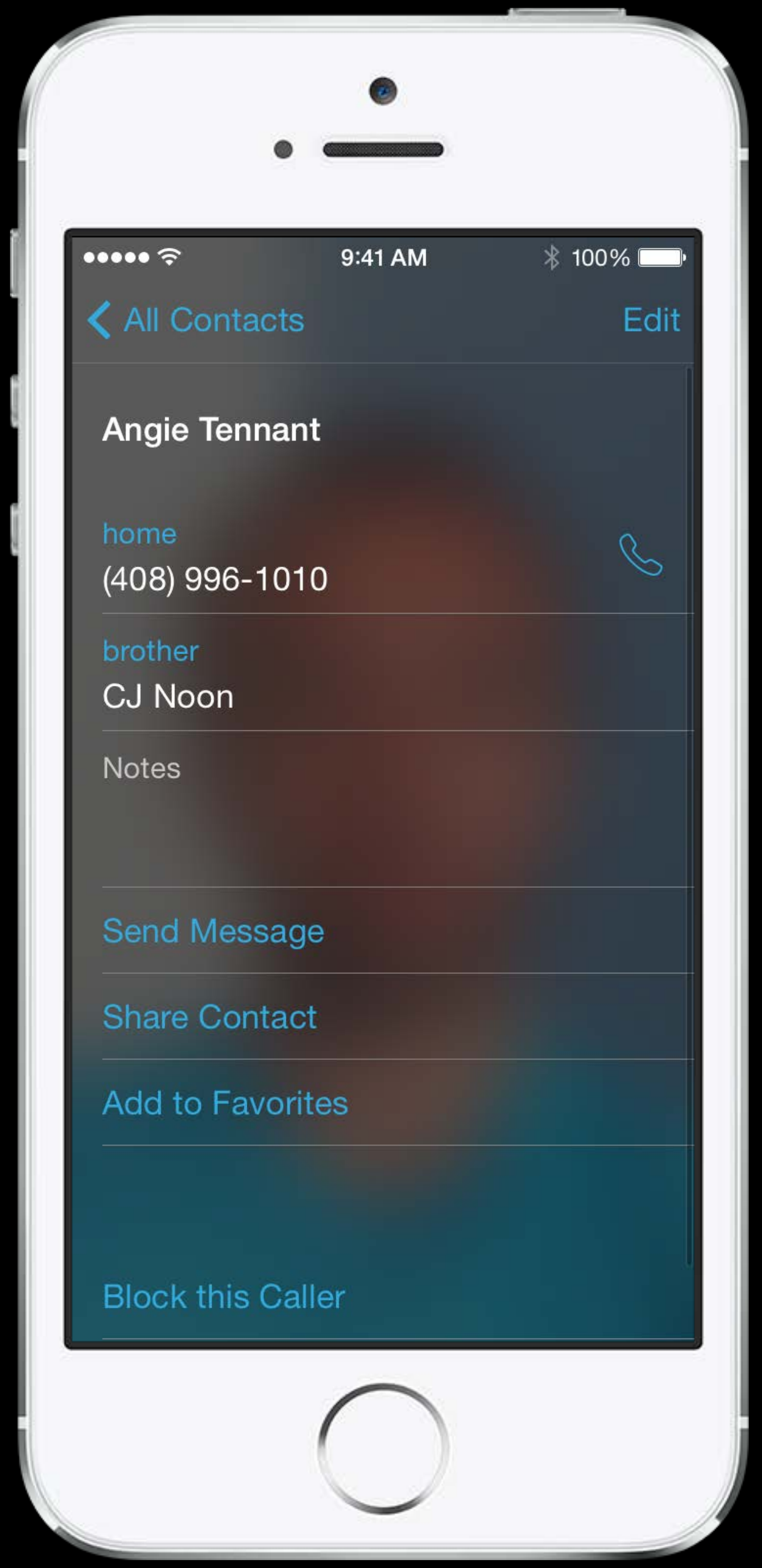
UIVisualEffectView

UIBlurEffect

NEW

More than a simple Gaussian blur

Downsample



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UIVisualEffectView

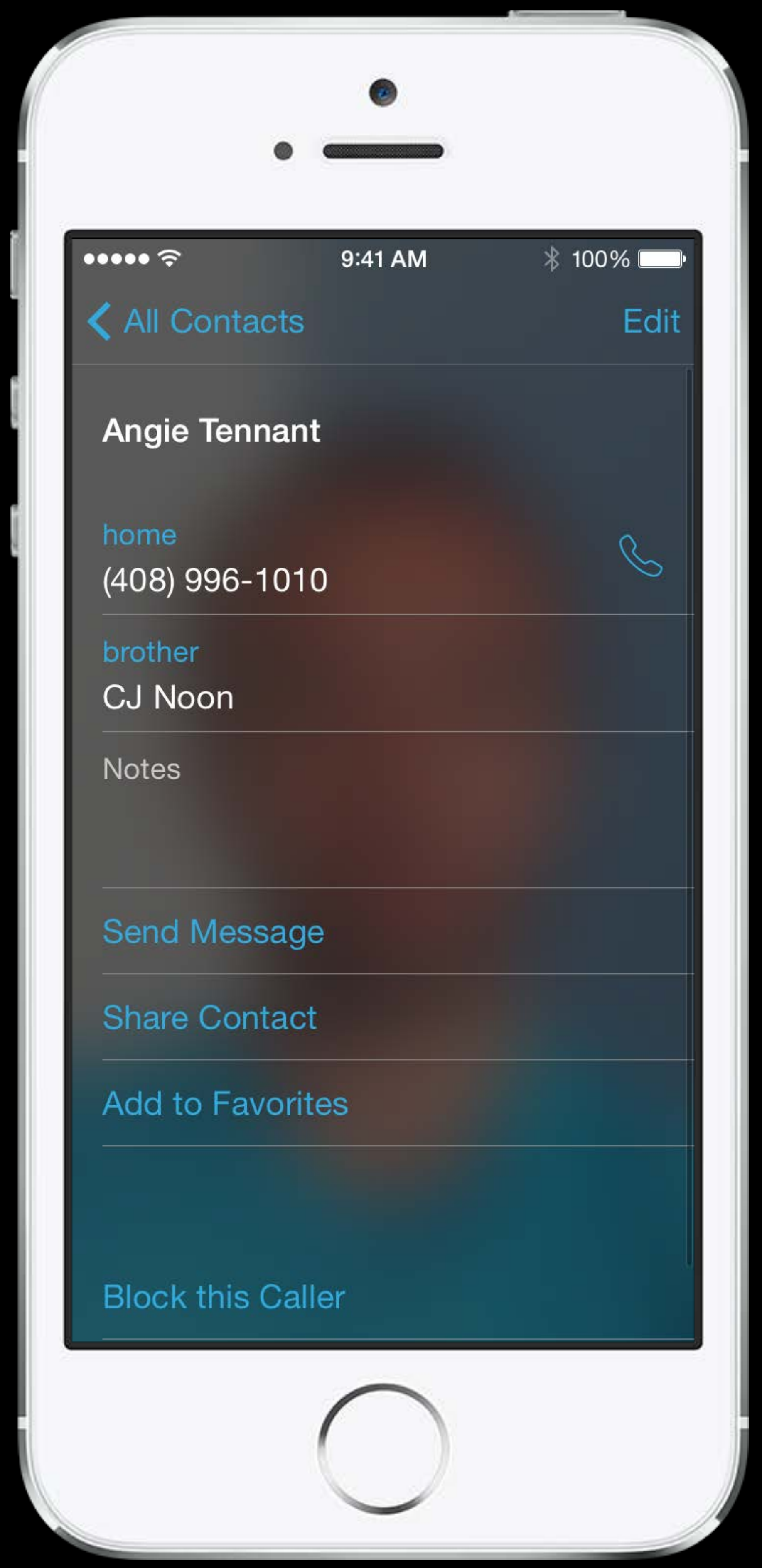
UIBlurEffect

NEW

More than a simple Gaussian blur

Downsample

Modify colors



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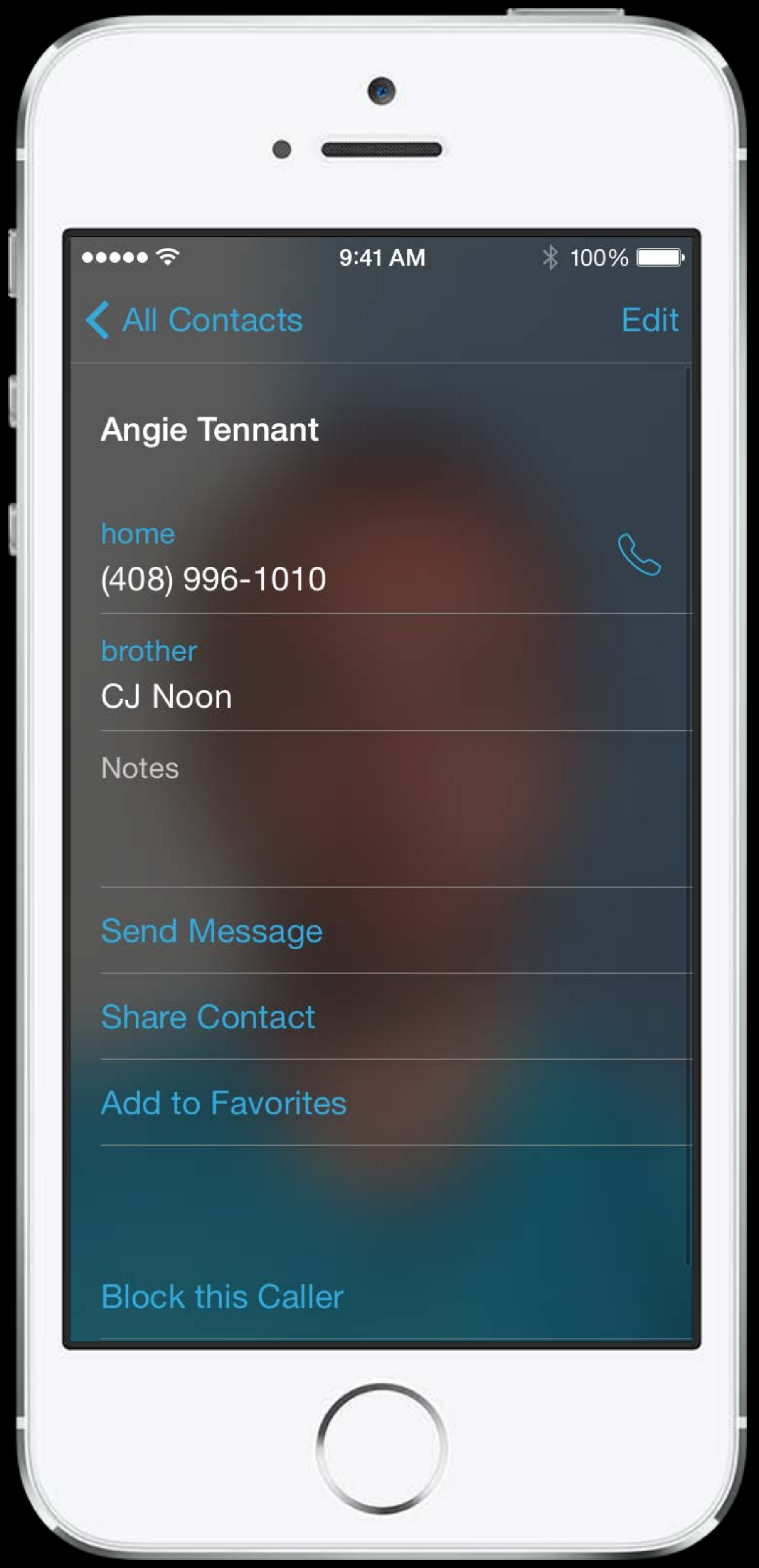
UIVisualEffectView

UIBlurEffect

NEW

- More than a simple Gaussian blur
- Downsample
- Modify colors
- Compute blurs



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‹ All Contacts Edit

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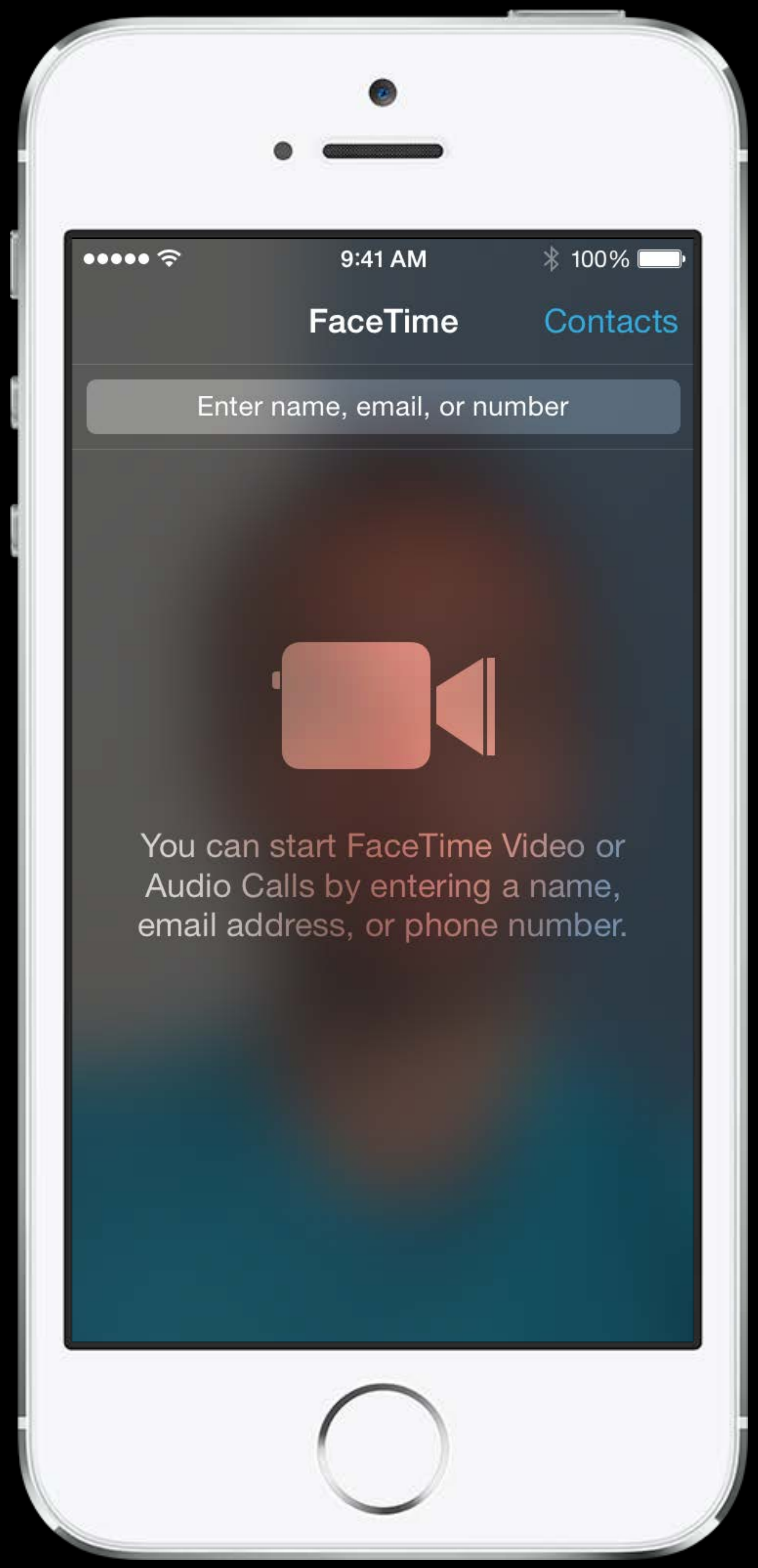
UIVisualEffectView

UIVibrancyEffect

NEW



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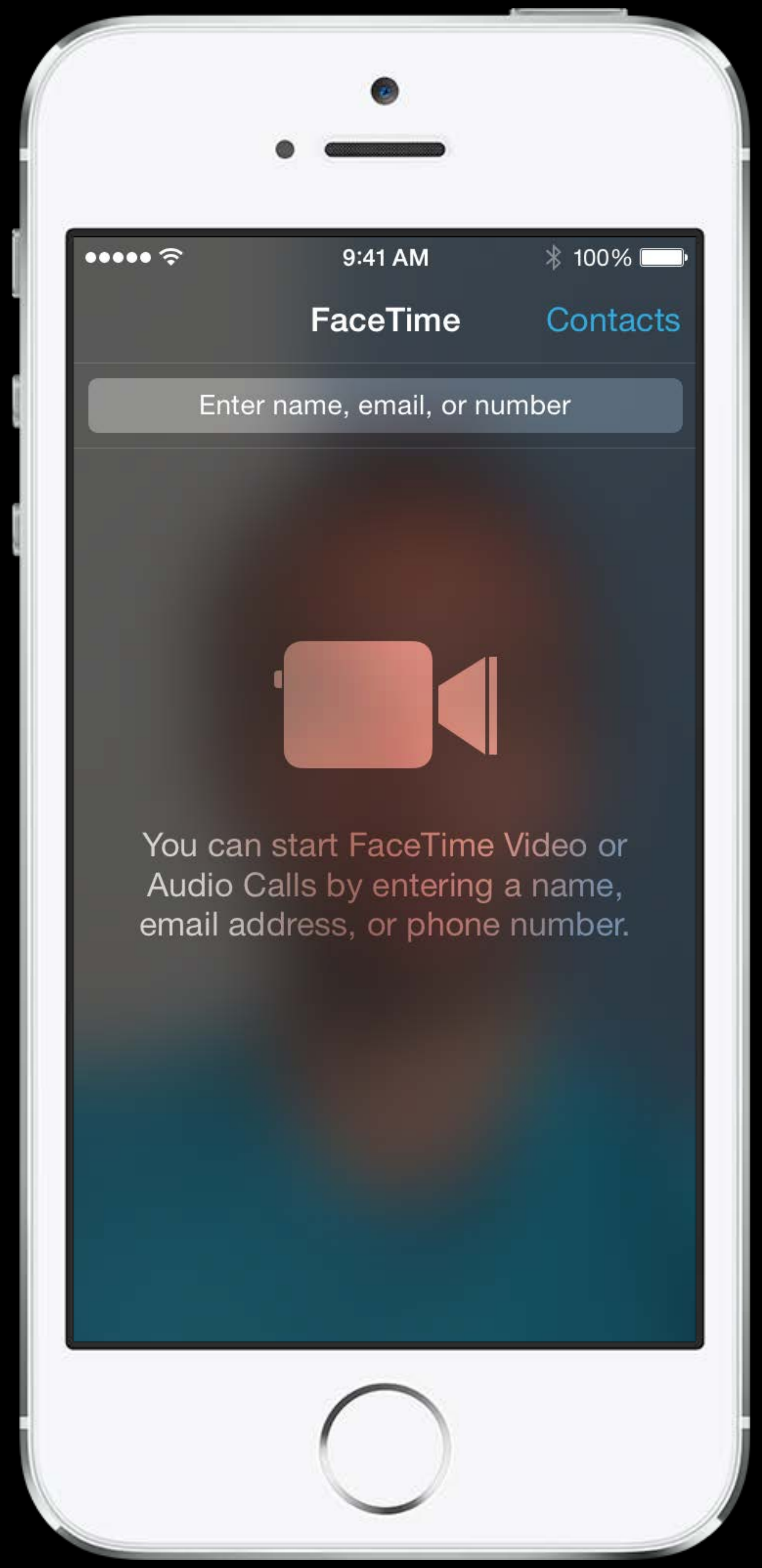
UIVisualEffectView

UIVibrancyEffect

NEW

Creates legible content above blurs



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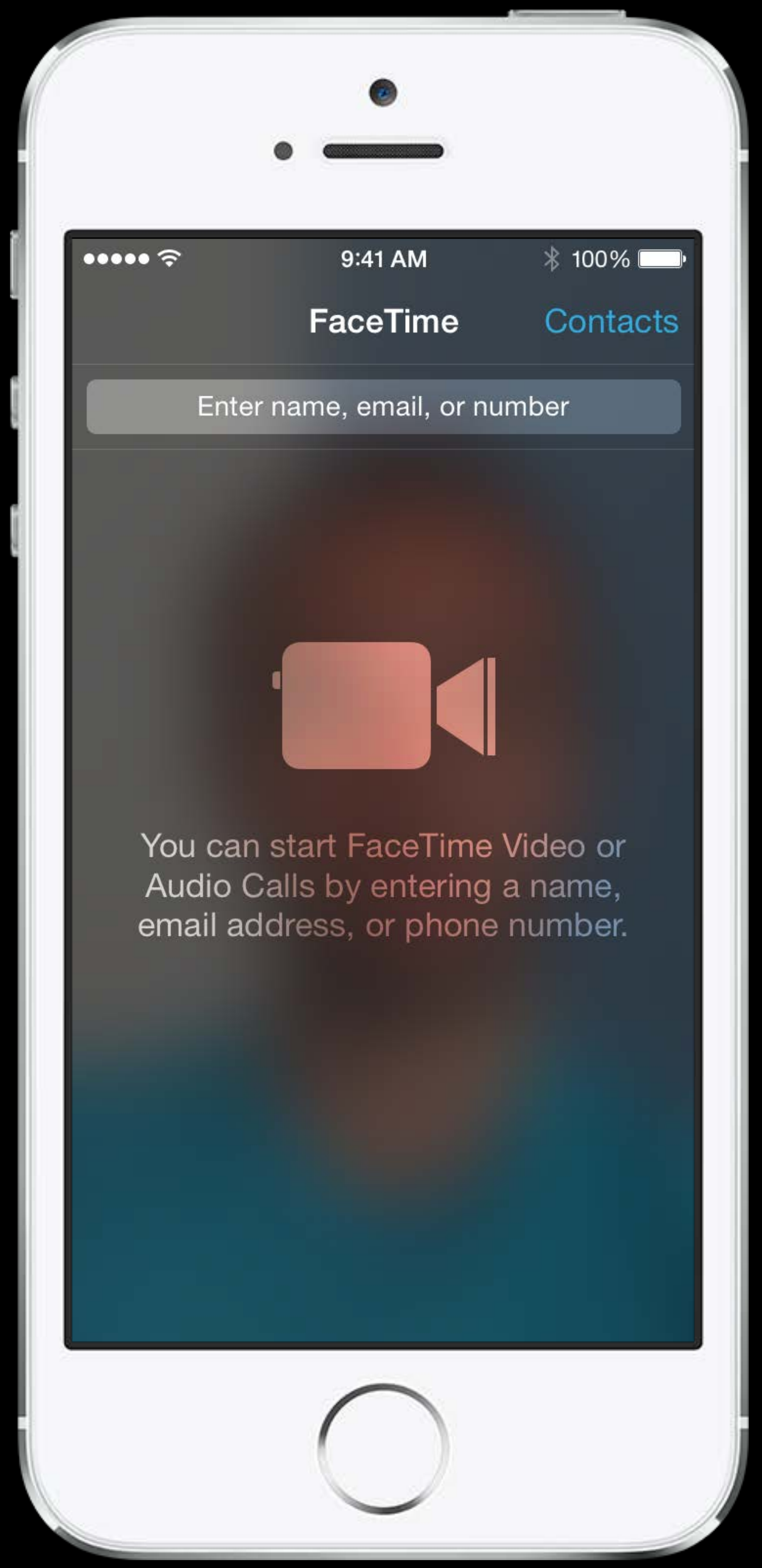
UIVisualEffectView

UIVibrancyEffect

NEW

Creates legible content above blurs

Boost saturation



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NEW

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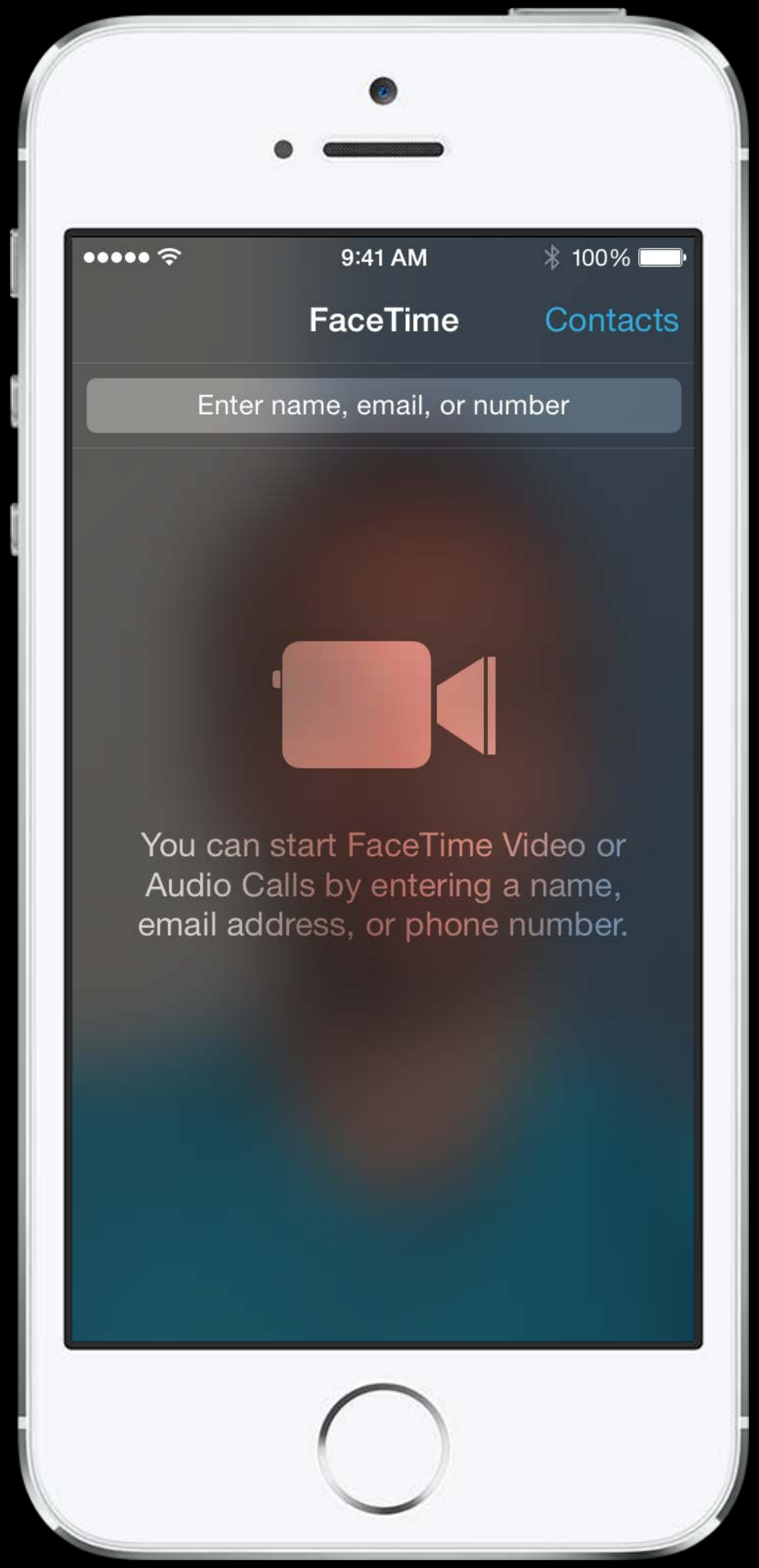
Boost saturation

Custom blend mode



You can start FaceTime Video or Audio Calls by entering a name, email address, or phone number.

UIVisualEffectView

UIVibrancyEffect

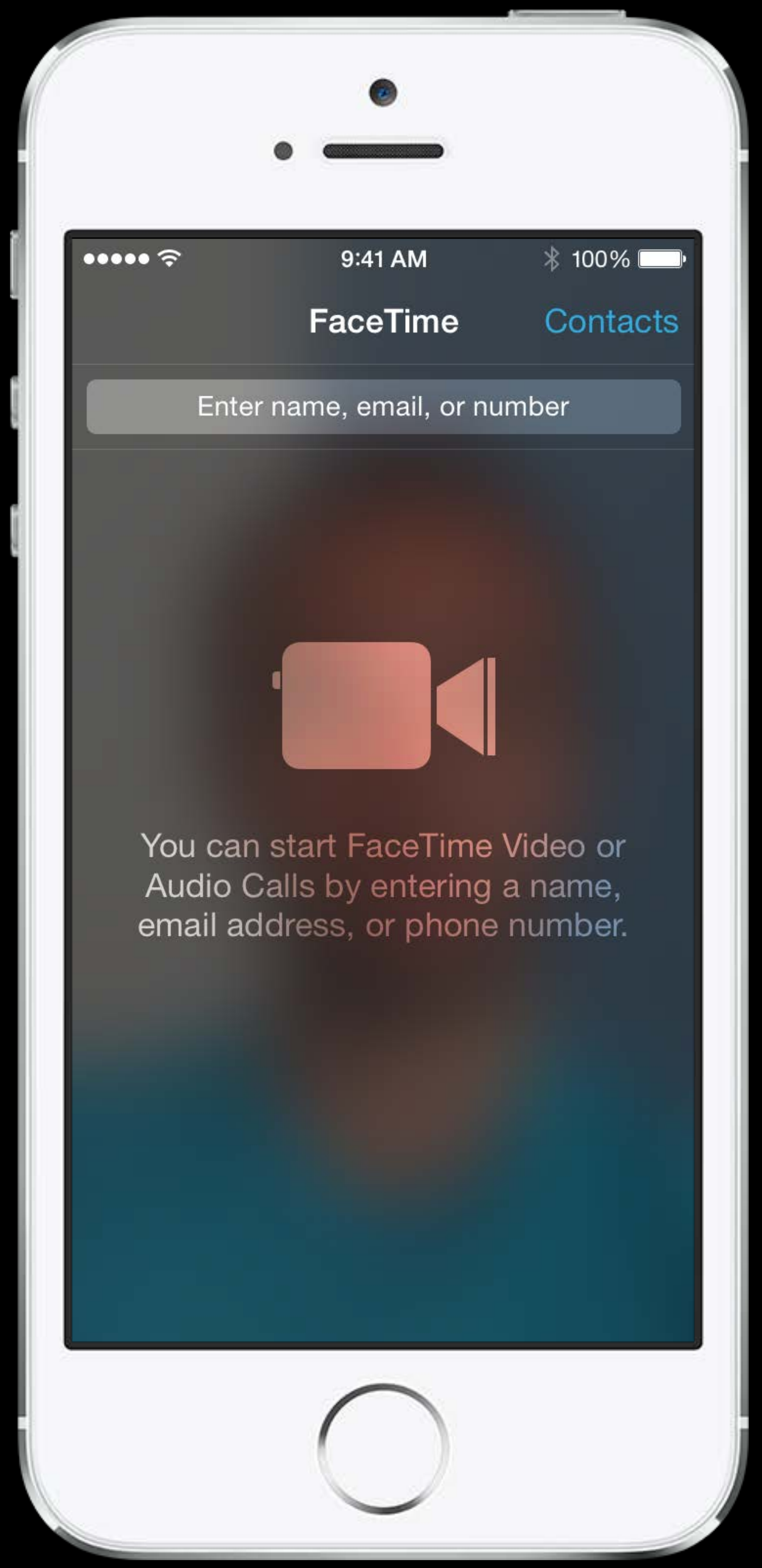
NEW

Creates legible content above blurs

Boost saturation

Custom blend mode

Behavior changes based on backing blur



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UIVisualEffectView

UIVibrancyEffect

NEW

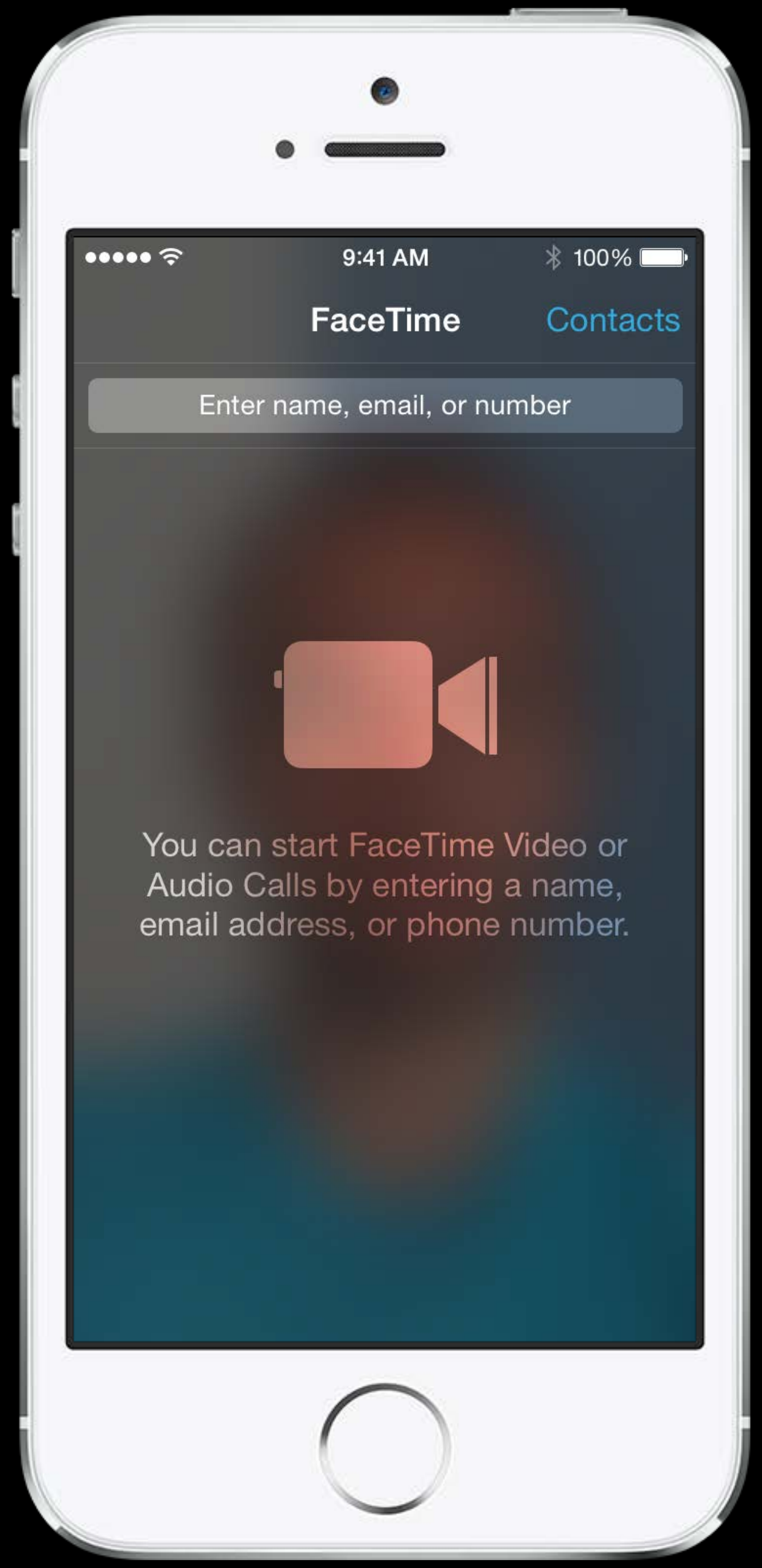
Creates legible content above blurs

Boost saturation

Custom blend mode

Behavior changes based on backing blur

Only supported with a blur effect



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UIVisualEffectView

How to use?

NEW

UIVisualEffectView

How to use?

NEW

Create a UIVisualEffect

UIVisualEffectView

How to use?

NEW

Create a UIVisualEffect

- UIBlurEffect

UIVisualEffectView

How to use?

NEW

Create a UIVisualEffect

- UIBlurEffect
- UIVibrancyEffect—takes a blur in the initializer

UIVisualEffectView

How to use?

NEW

Create a UIVisualEffect

- UIBlurEffect
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Create a UIVisualEffectView with a UIVisualEffect

UIVisualEffectView

How to use?

Create a UIVisualEffect

- UIBlurEffect
- UIVibrancyEffect—takes a blur in the initializer

Create a UIVisualEffectView with a UIVisualEffect

Add subviews to its `contentView`

UIVisualEffectView

Customizability

UIVisualEffectView

Customizability

Tint blurs by changing `backgroundColor` on `contentView`

UIVisualEffectView

Customizability

Tint blurs by changing `backgroundColor` on `contentView`

Animate frame changes

UIVisualEffectView

Caveats

UIVisualEffectView

Caveats

Setting alpha is at odds with blur

UIVisualEffectView

Caveats

Setting alpha is at odds with blur

Avoid placing a UIVisualEffectView in a view hierarchy that contains masks

UIVisualEffectView

Caveats

Setting alpha is at odds with blur

Avoid placing a UIVisualEffectView in a view hierarchy that contains masks

Beware of groups that can affect your UIVisualEffectView

UIVisualEffectView

Caveats

Setting alpha is at odds with blur

Avoid placing a UIVisualEffectView in a view hierarchy that contains masks

Beware of groups that can affect your UIVisualEffectView

- Animation groups

UIVisualEffectView

Caveats

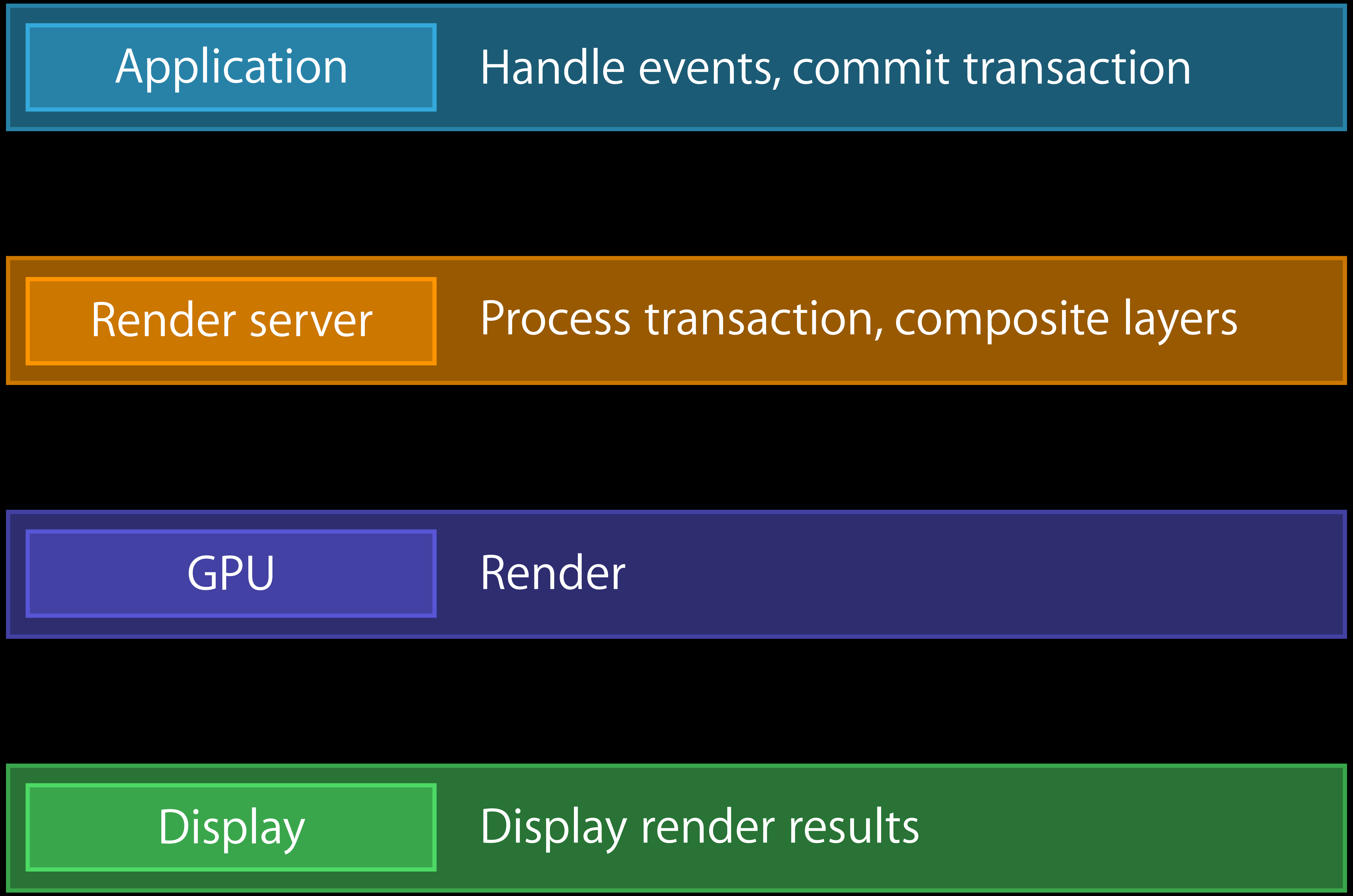
Setting alpha is at odds with blur

Avoid placing a UIVisualEffectView in a view hierarchy that contains masks

Beware of groups that can affect your UIVisualEffectView

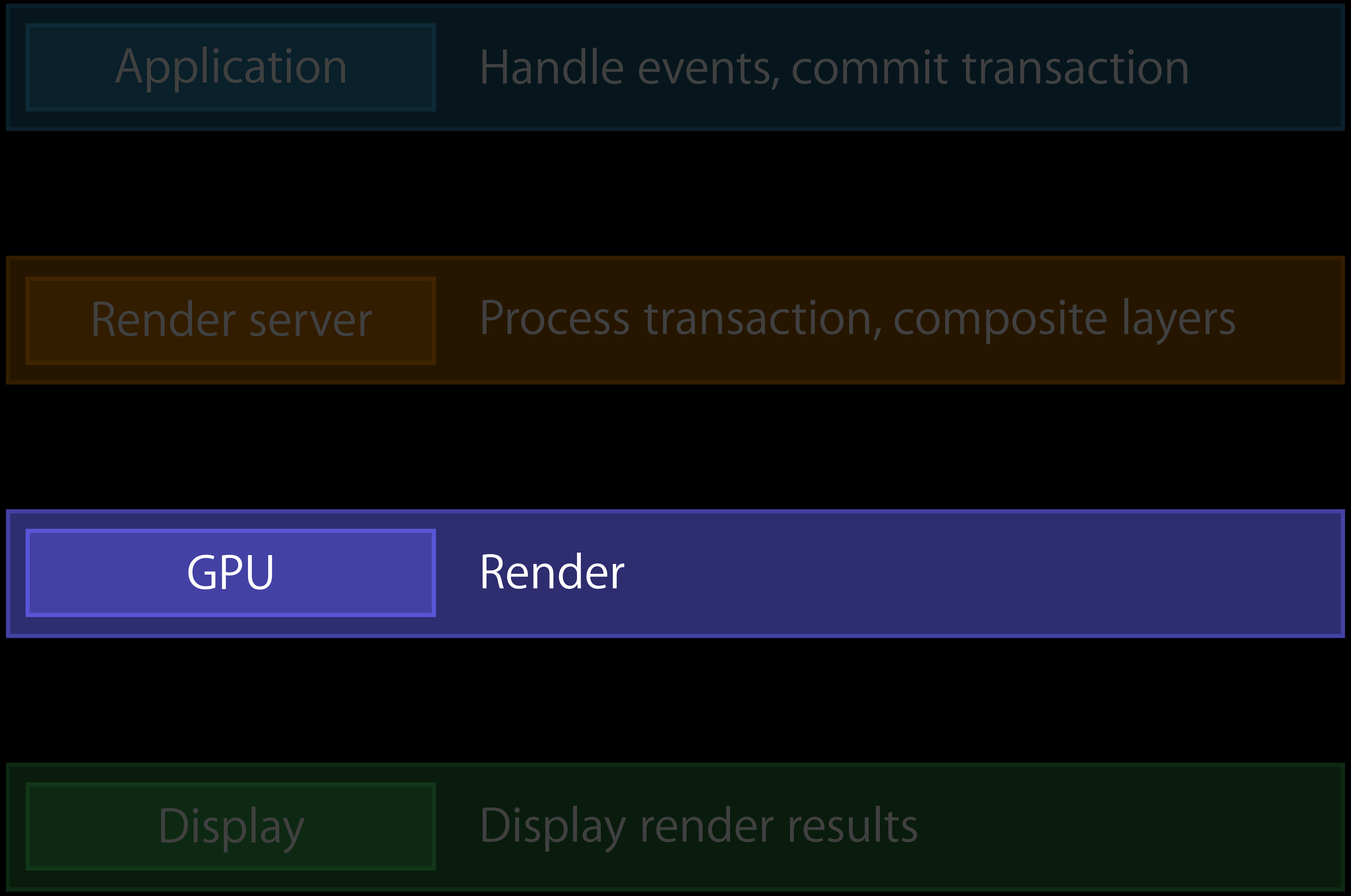
- Animation groups
- Opacity groups

Rendering Pipeline



Application	Handle events, commit transaction
Render server	Process transaction, composite layers
GPU	Render
Display	Display render results

Rendering Pipeline



Application Handle events, commit transaction

Render server Process transaction, composite layers

GPU Render

Display Display render results

UIVisualEffectView

Rendering cost

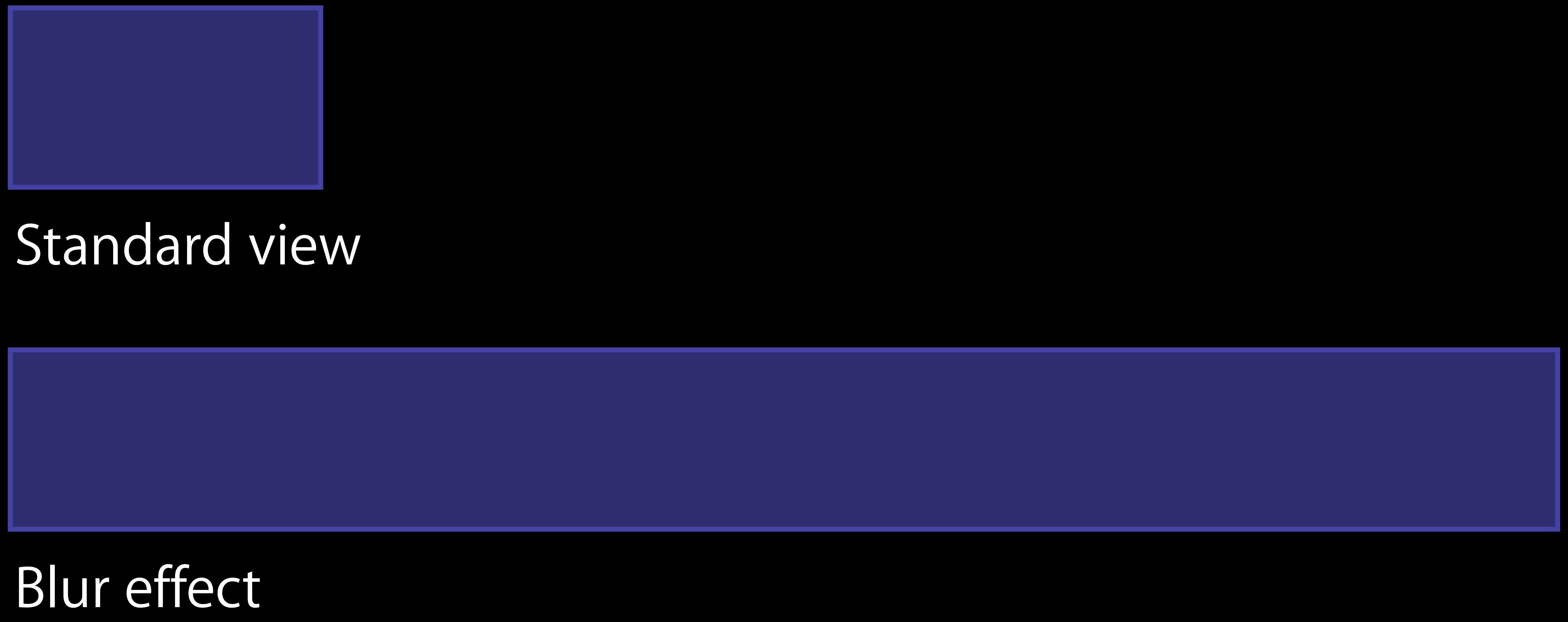
UIVisualEffectView

Rendering cost

Standard view

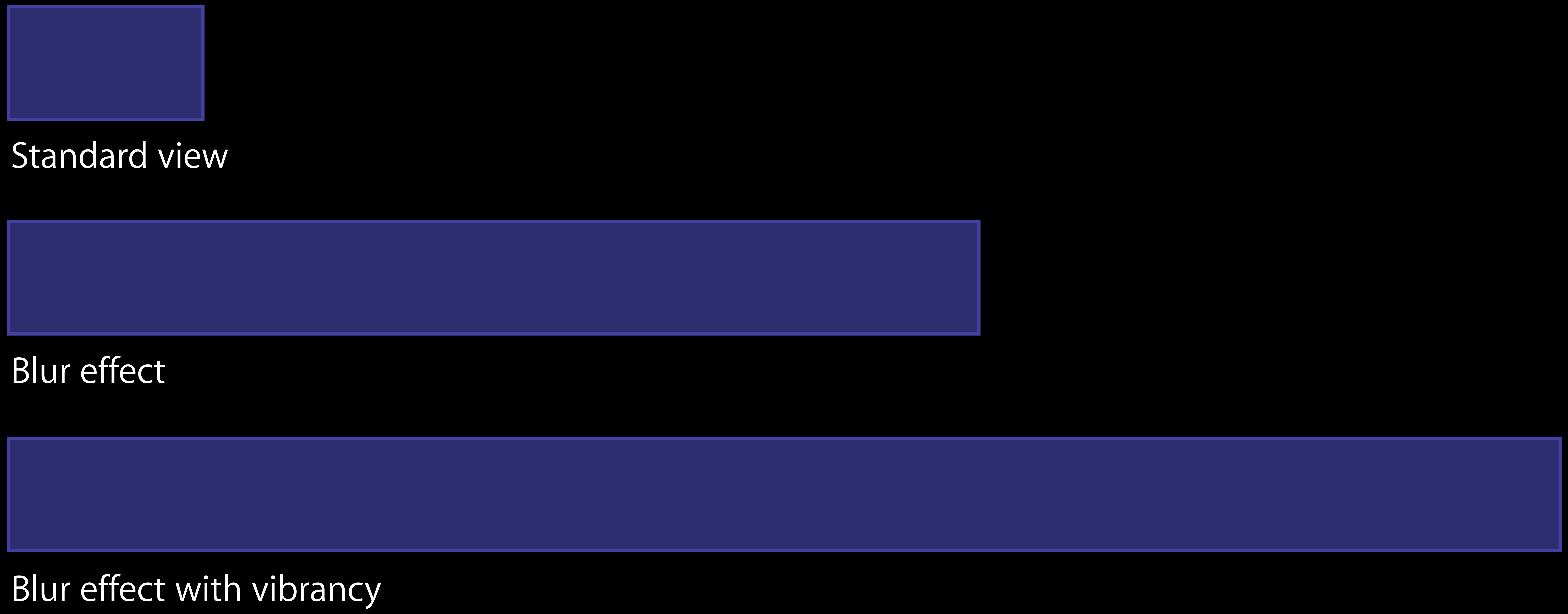
UIVisualEffectView

Rendering cost



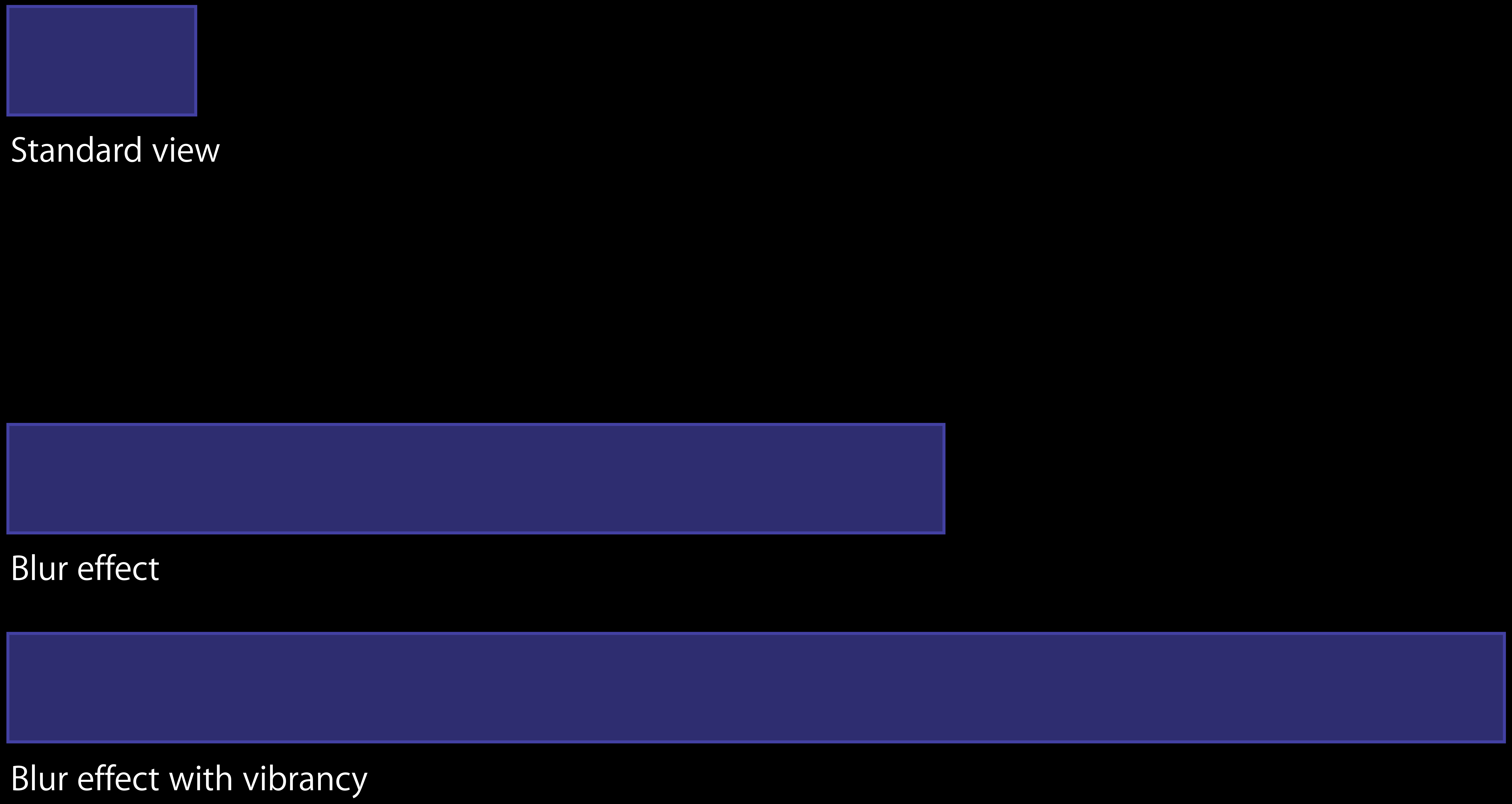
UIVisualEffectView

Rendering cost



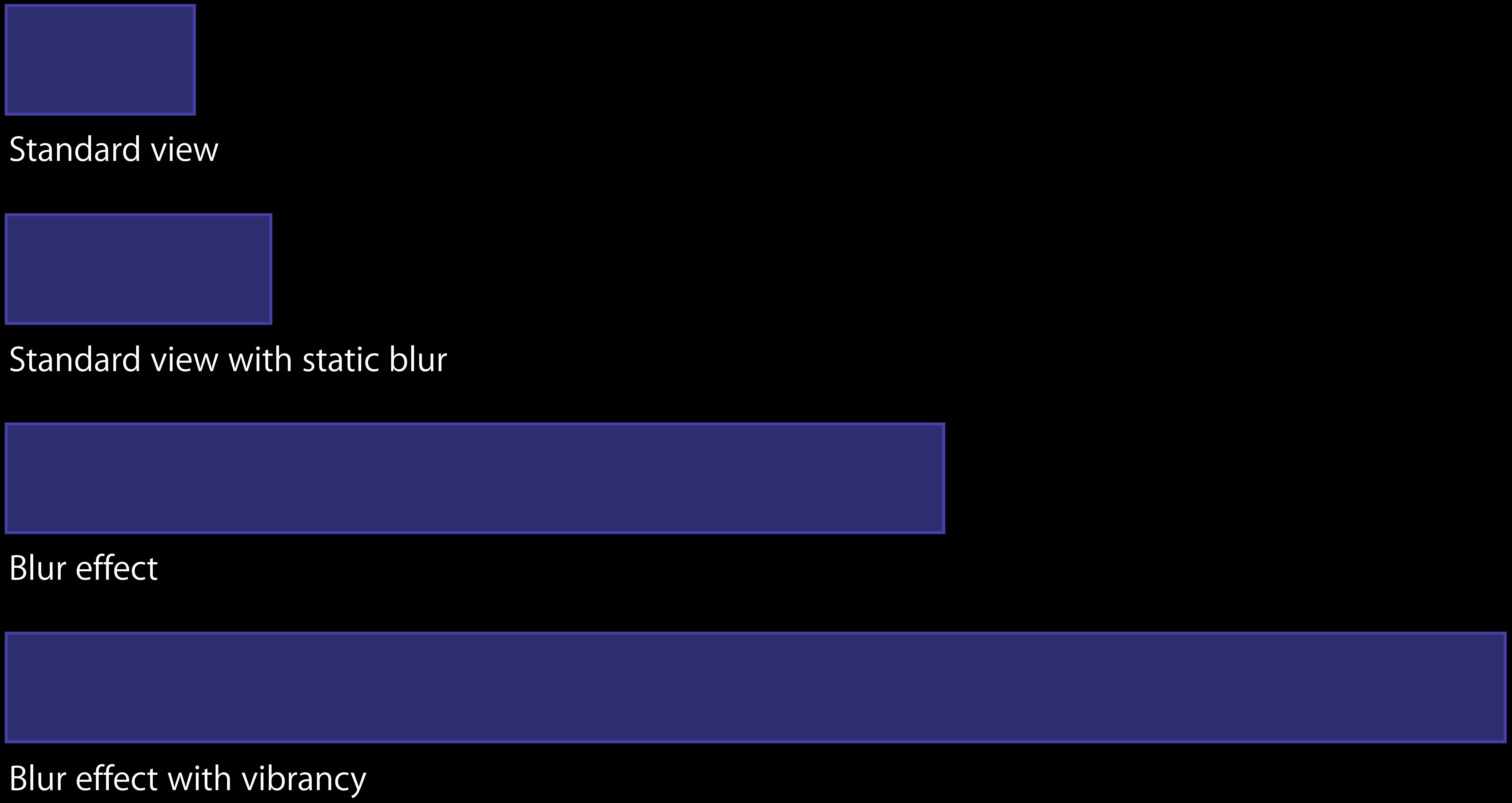
UIVisualEffectView

Rendering cost



UIVisualEffectView

Rendering cost



Demo

UIVisualEffectView

CAShapeLayer

A great way to draw custom content

CAShapeLayer

Why is it useful?

CAShapeLayer

Why is it useful?

Powerful tool to draw custom Bézier paths

CAShapeLayer

Why is it useful?

Powerful tool to draw custom Bézier paths

CALayer subclass, easy to use in existing view hierarchies

CAShapeLayer

Why is it useful?

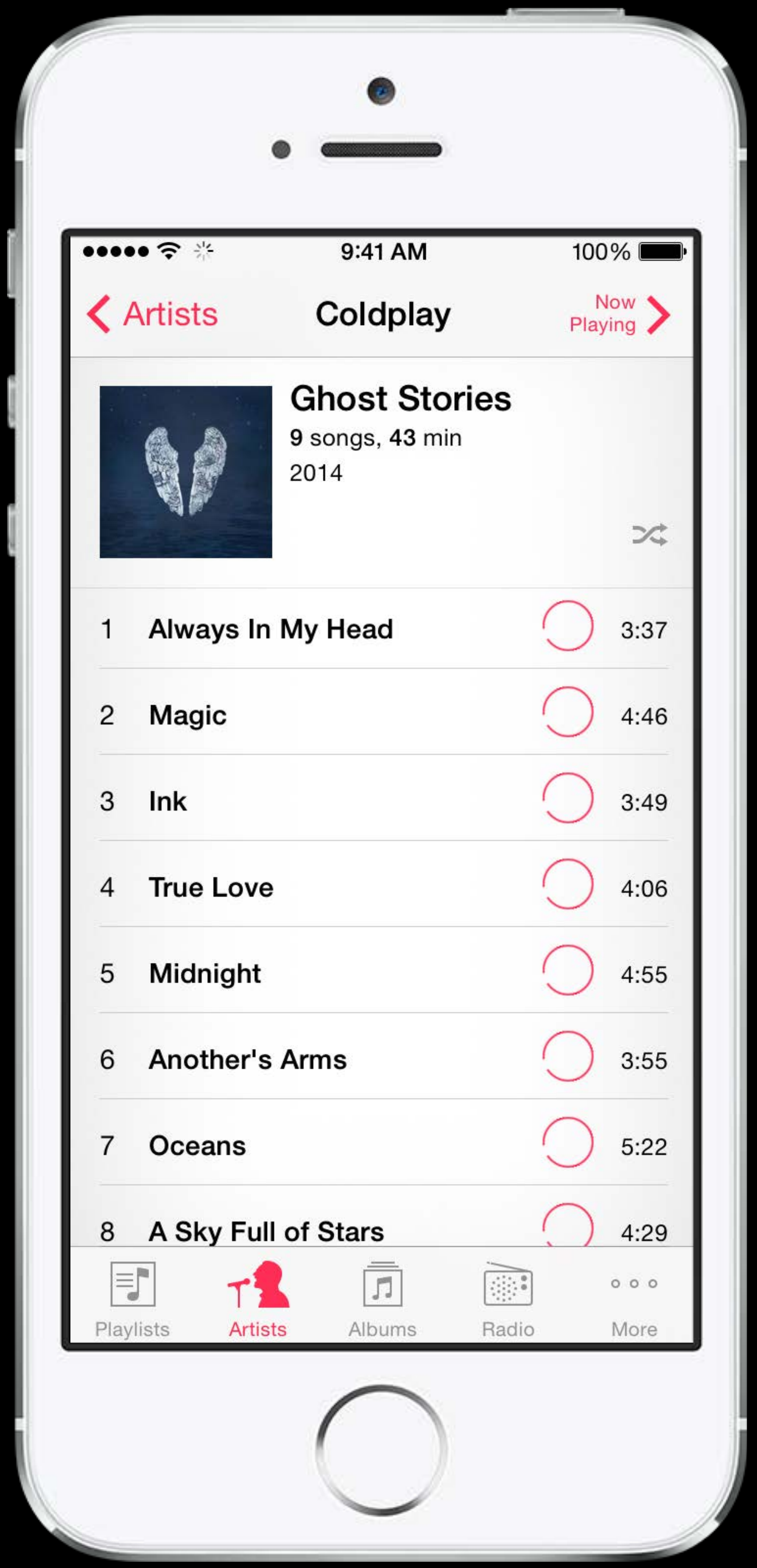
Powerful tool to draw custom Bézier paths

CALayer subclass, easy to use in existing view hierarchies

Animatable

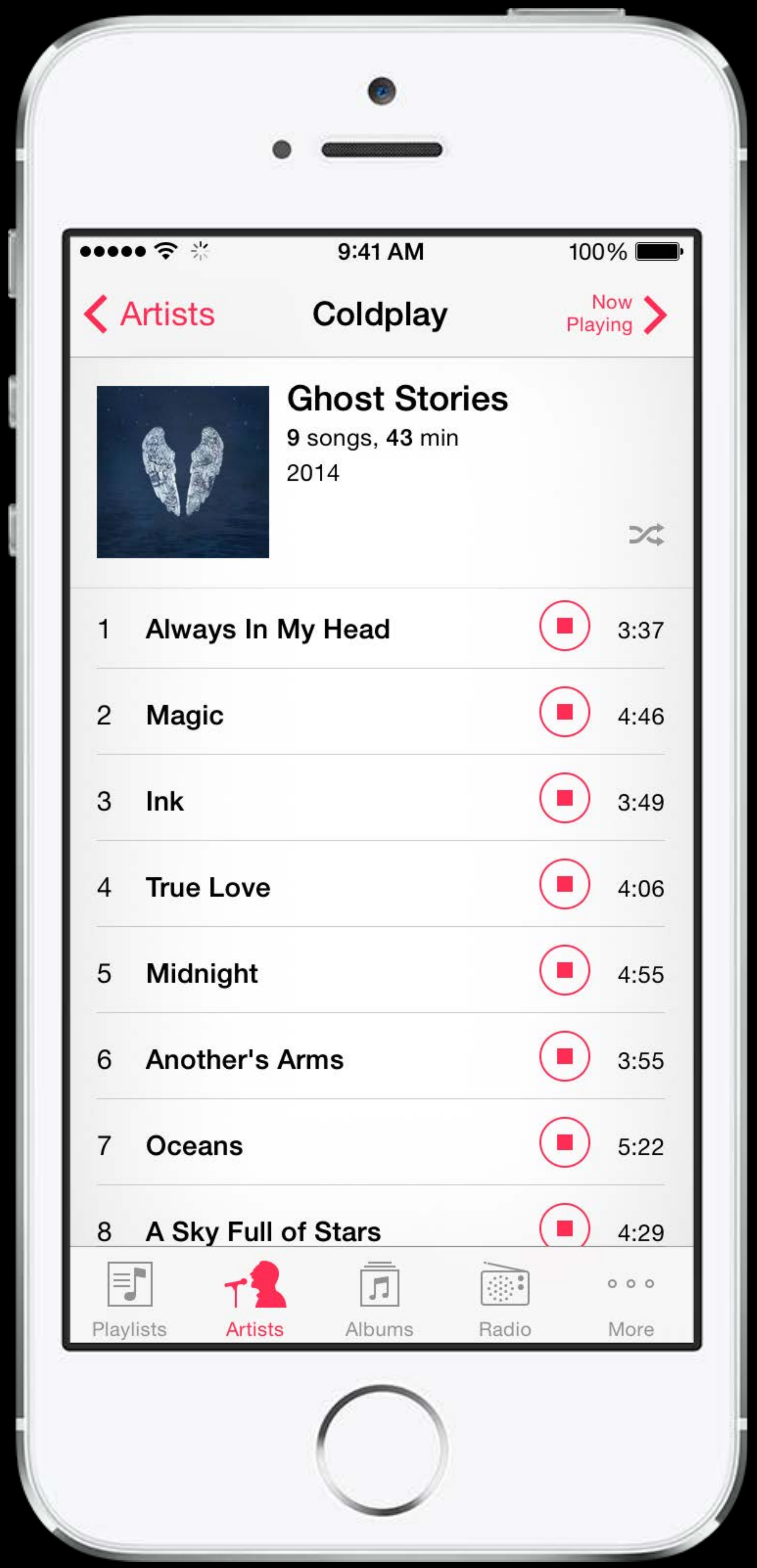
CAShapeLayer

Why is it useful?



Ghost Stories
9 songs, 43 min
2014

1	Always In My Head	3:37
2	Magic	4:46
3	Ink	3:49
4	True Love	4:06
5	Midnight	4:55
6	Another's Arms	3:55
7	Oceans	5:22
8	A Sky Full of Stars	4:29



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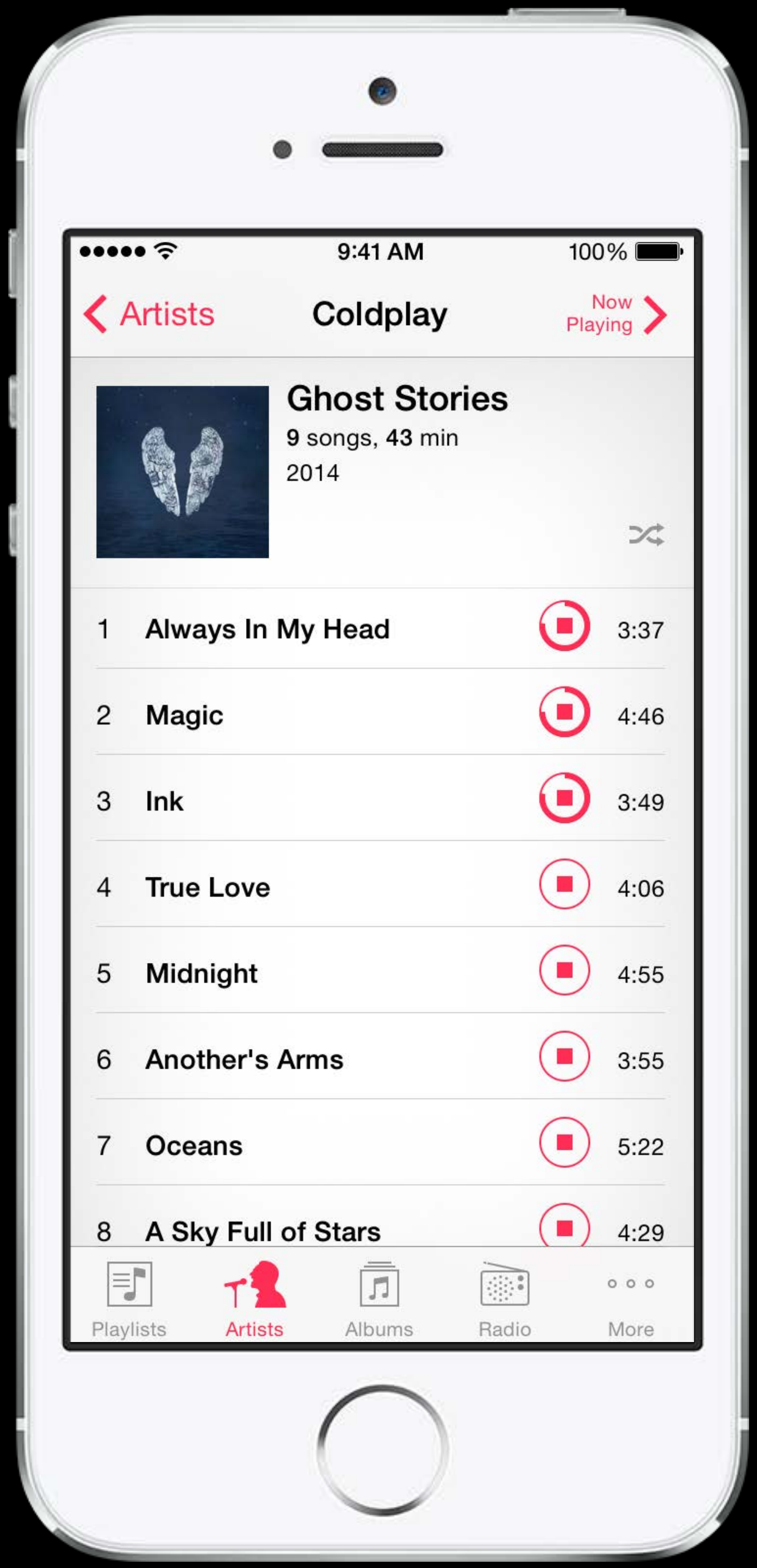

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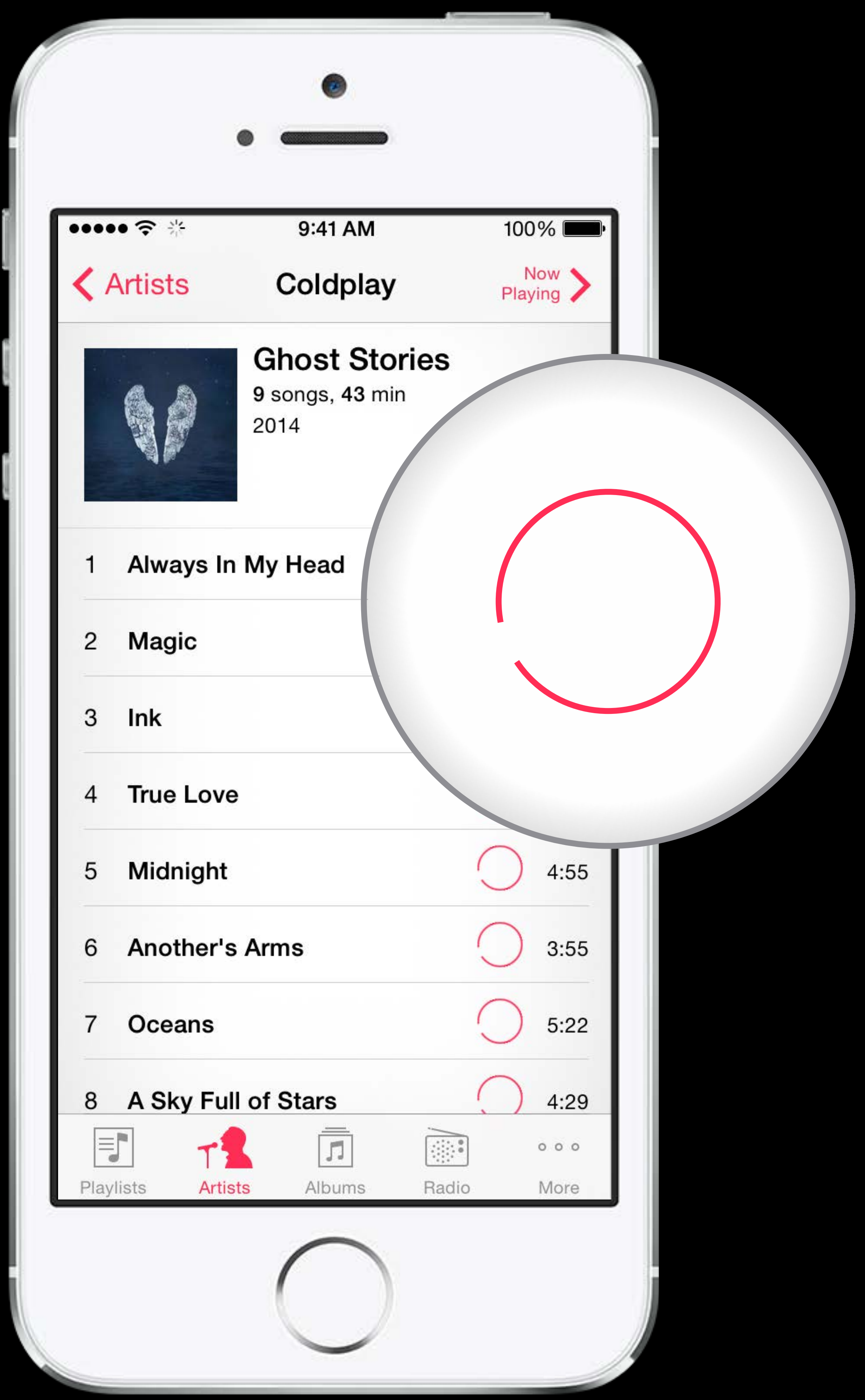
CAShapeLayer

Why is it useful?



9:41 AM 100%

Artists | Coldplay | Now Playing

Ghost Stories
9 songs, 43 min
2014

1	Always In My Head	
2	Magic	
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4	True Love	
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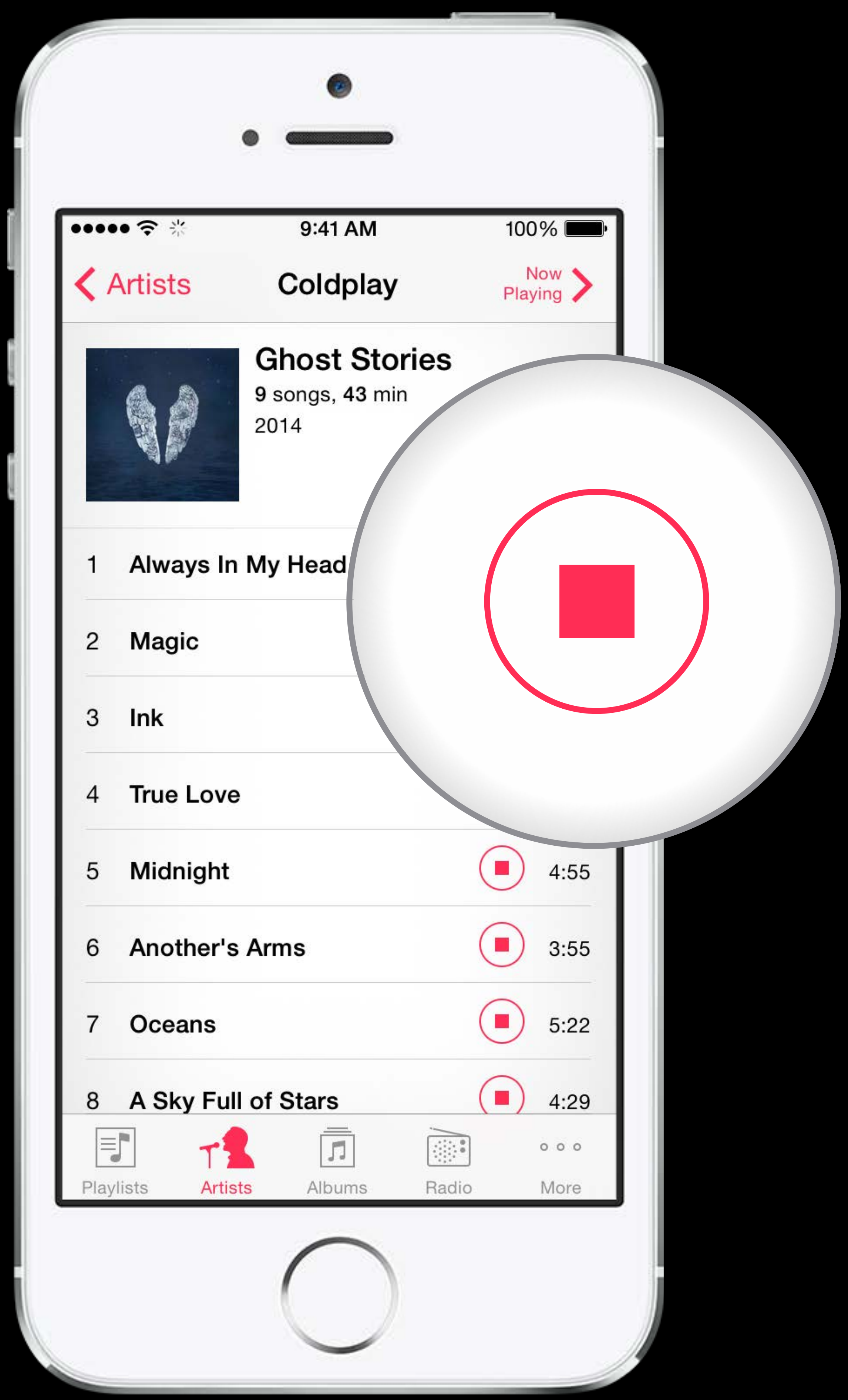

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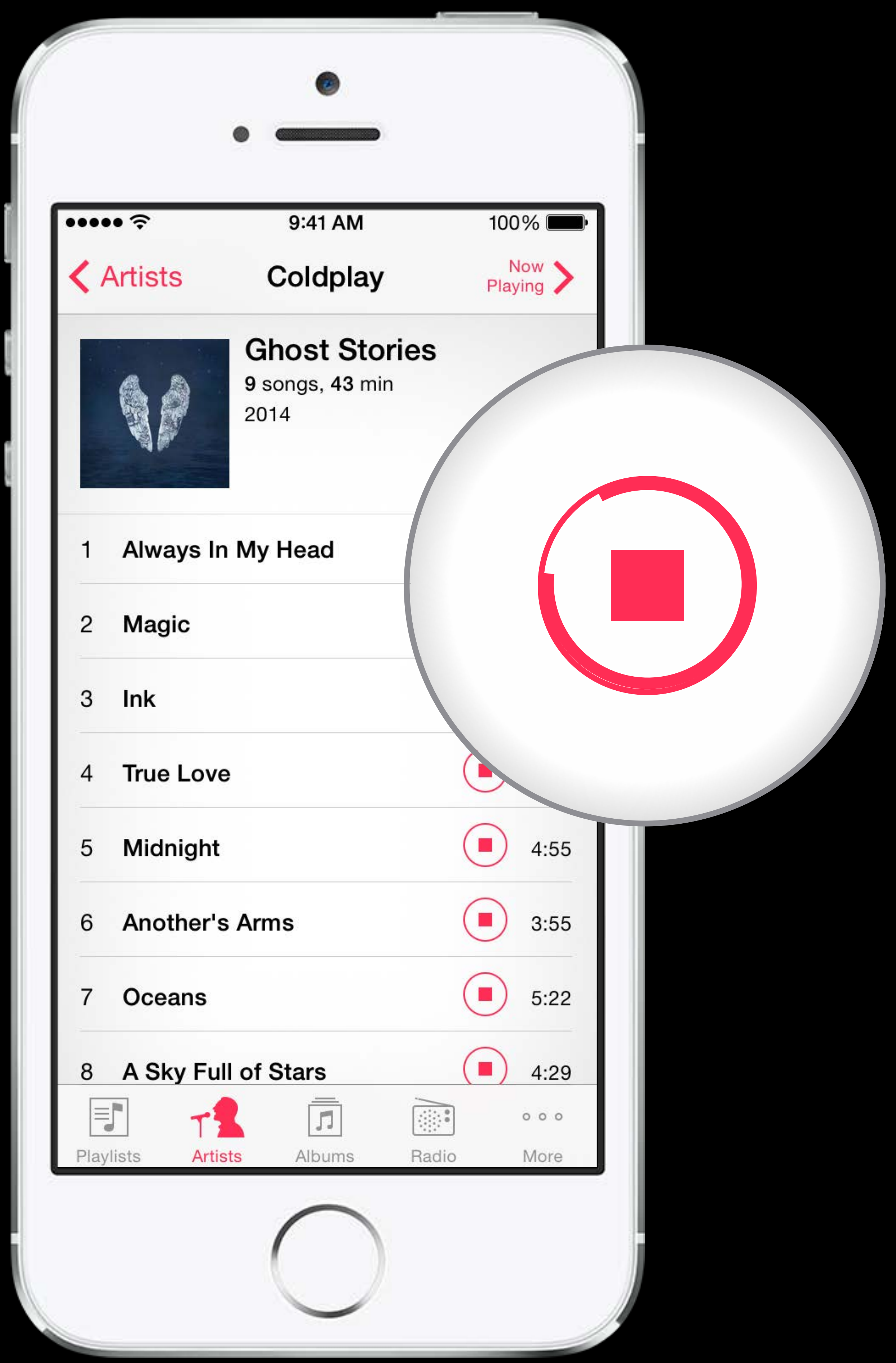

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7	Oceans	5:22
8	A Sky Full of Stars	4:29

CAShapeLayer

Path

CAShapeLayer

Path

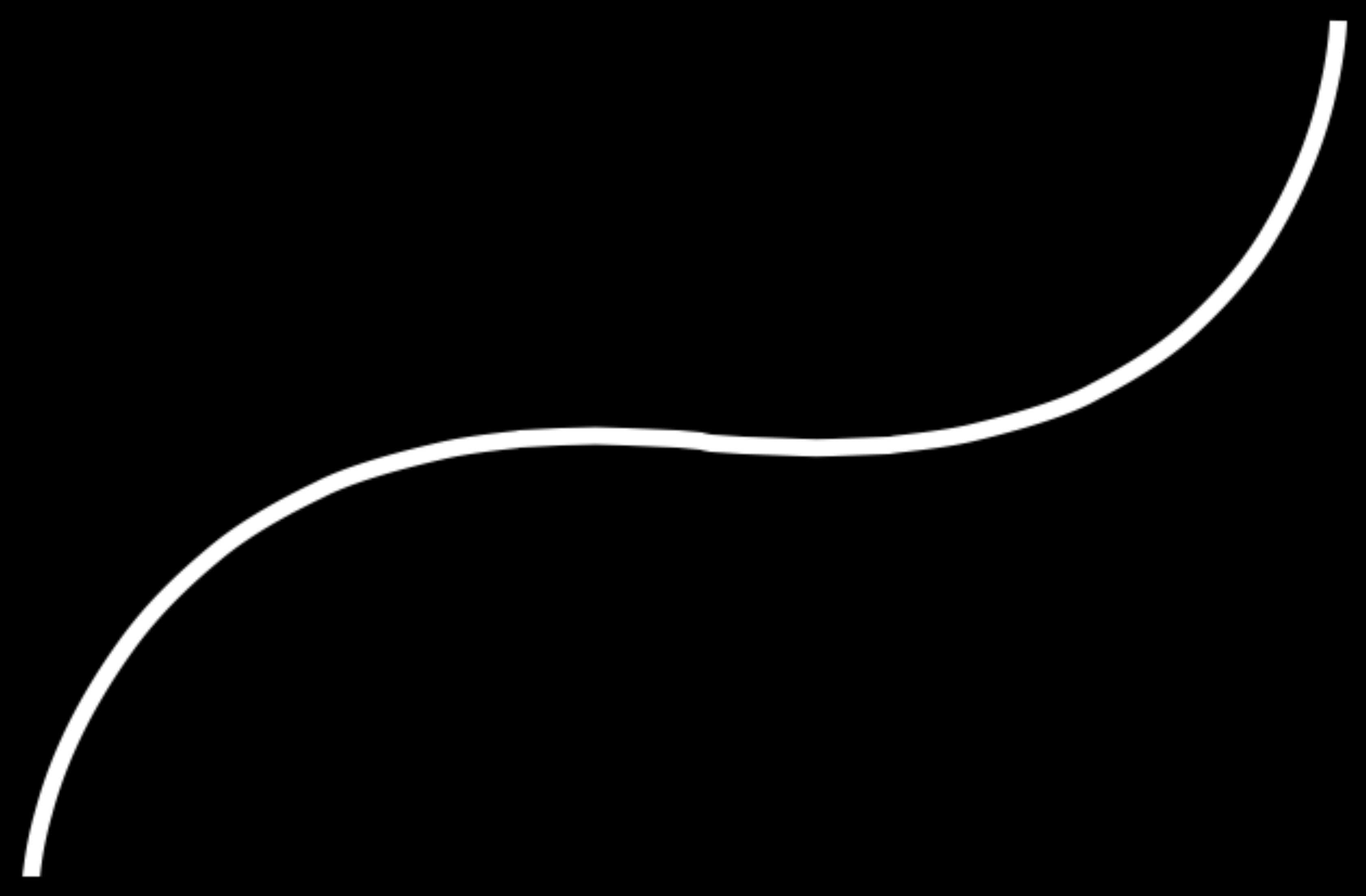
```
@property CGPathRef path;
```

CAShapeLayer

Path

```
bezierPath = [UIBezierPath bezierPath];

[bezierPath moveToPoint:CGPointMake(0,
220)];
[bezierPath addCurveToPoint:
CGPointMake(160, 115)
controlPoint1:CGPointMake(0, 220)
controlPoint2:CGPointMake(15, 100)];
[bezierPath addCurveToPoint:
CGPointMake(305, 20)
controlPoint1:CGPointMake(300, 132)
controlPoint2:CGPointMake(305, 20)];
[shapeLayer setPath:bezierPath.CGPath];
```



CAShapeLayer

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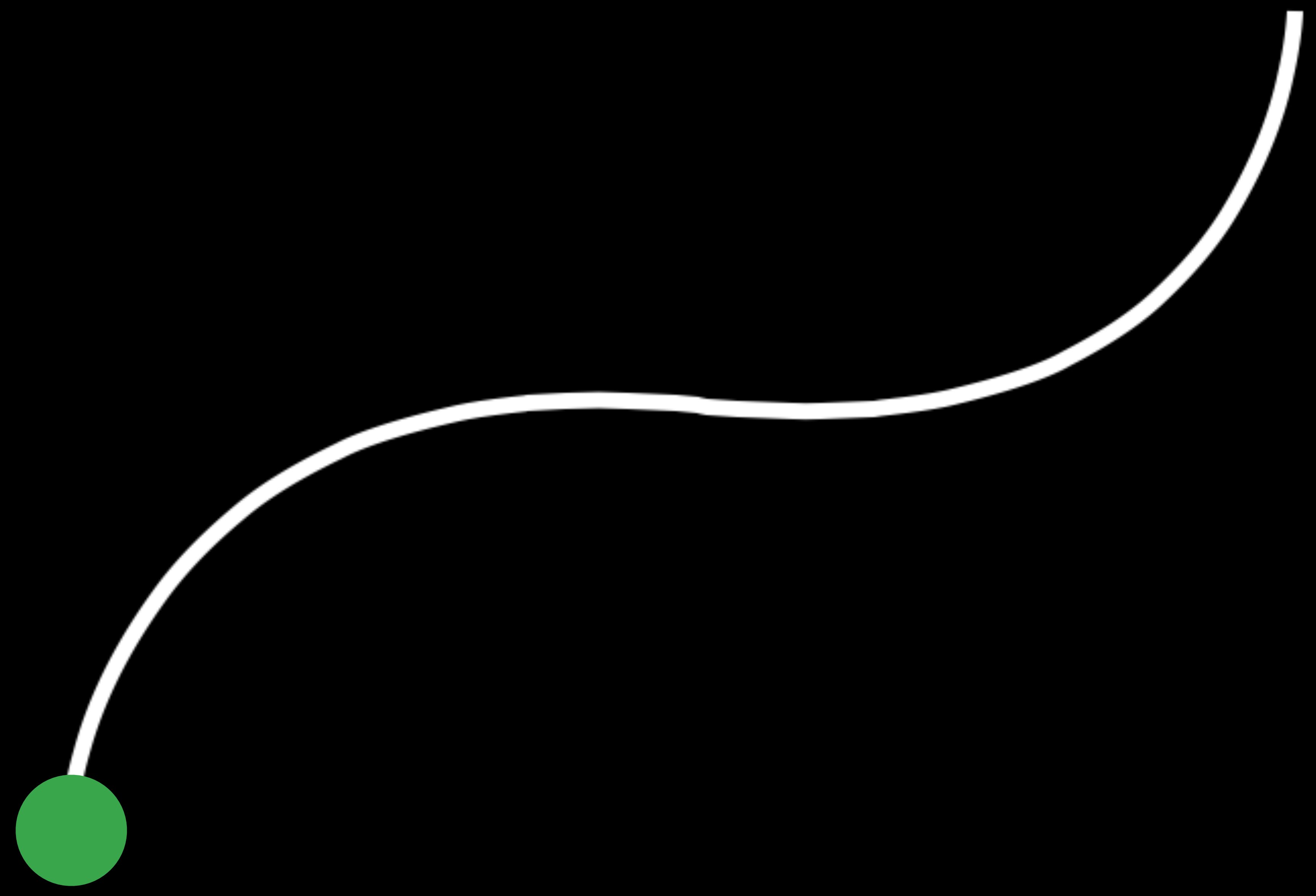

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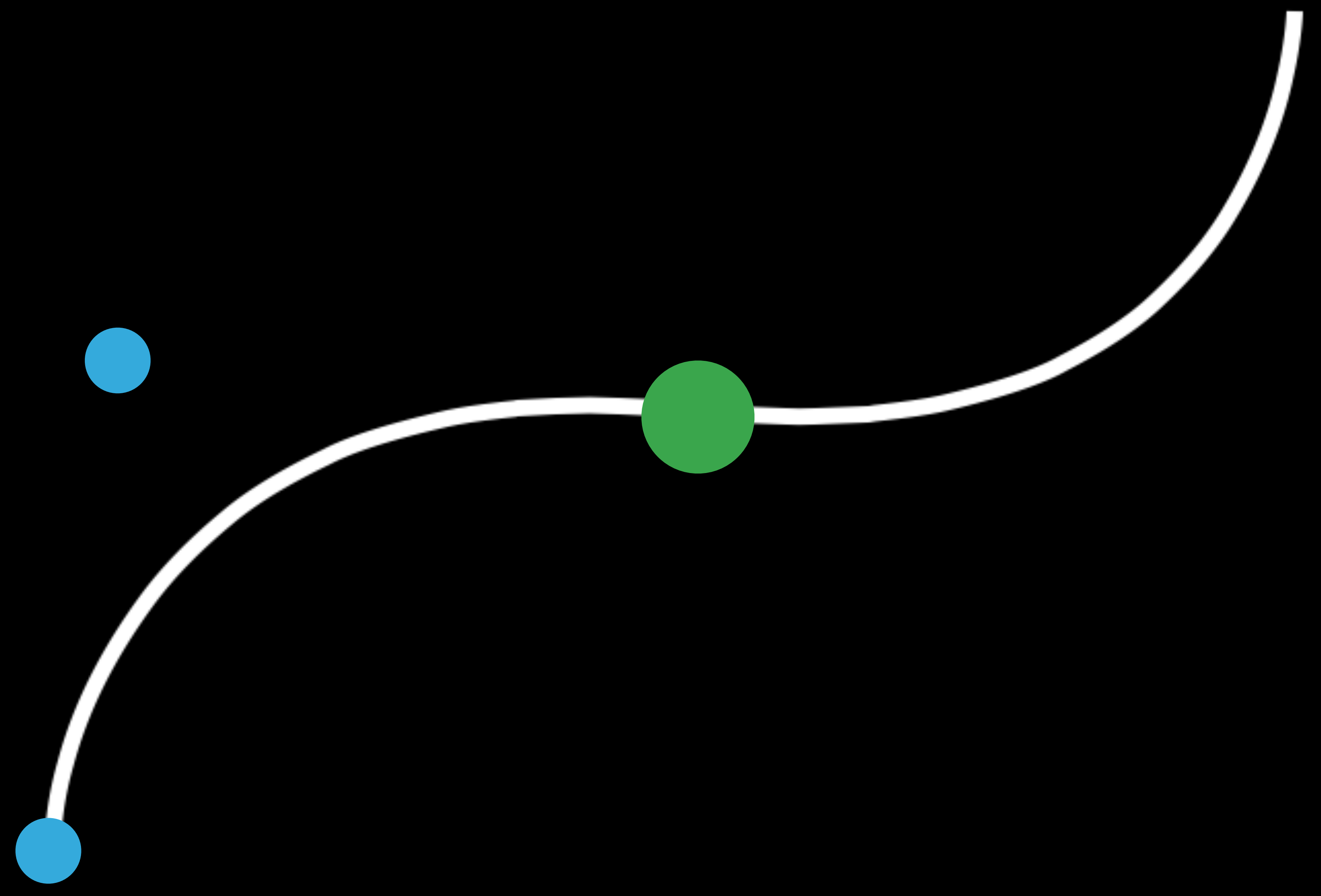

CAShapeLayer

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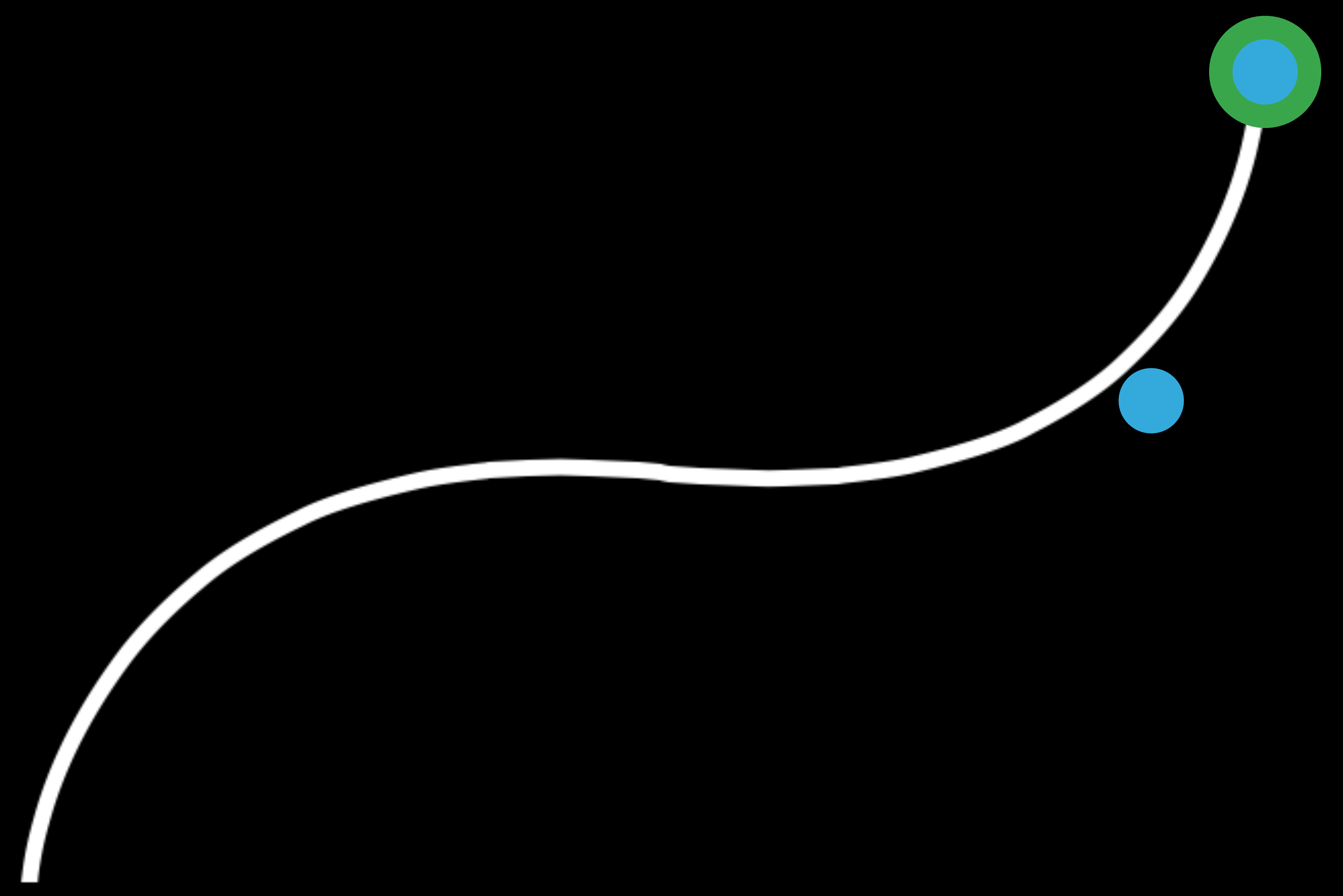

CAShapeLayer

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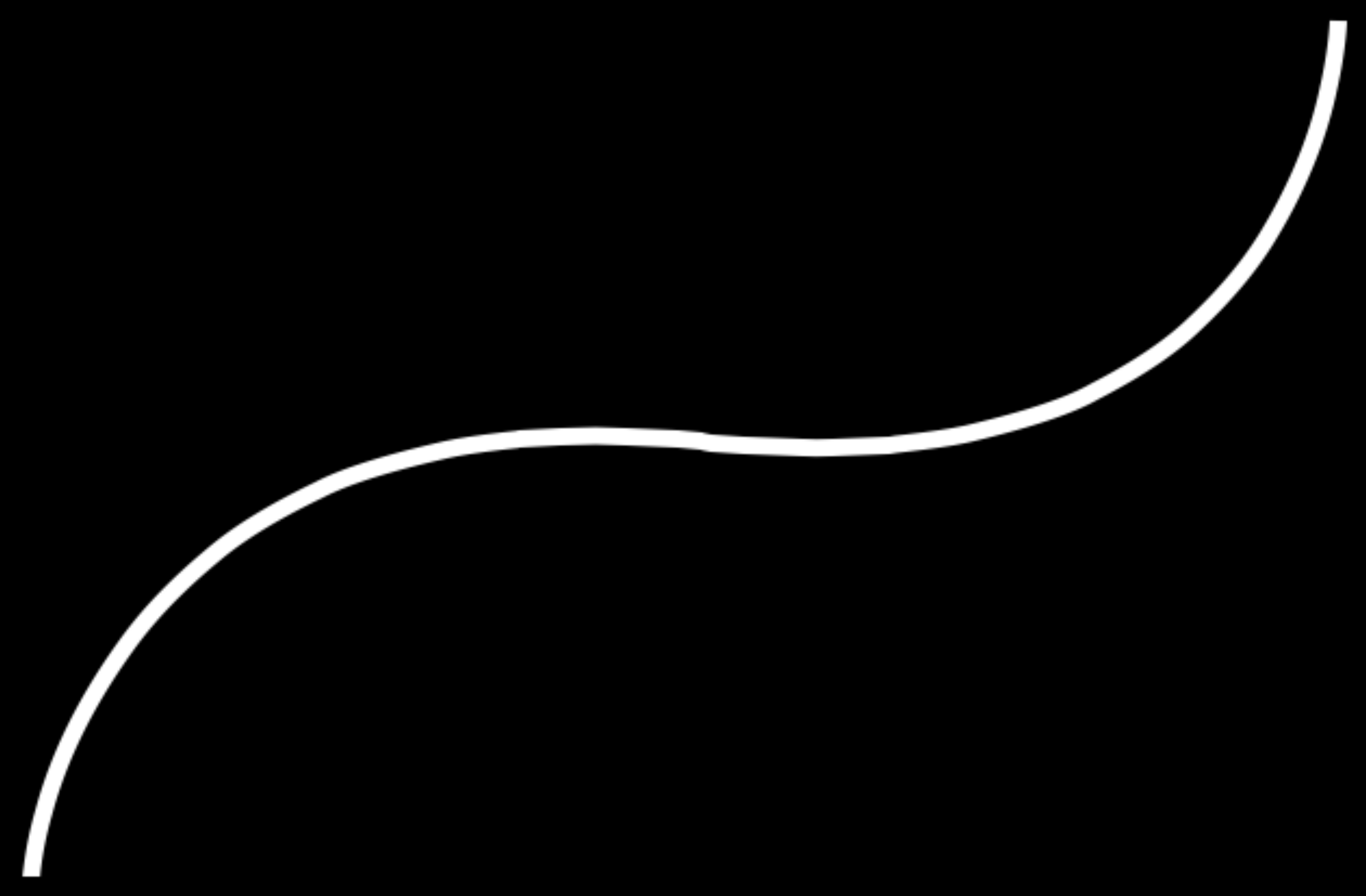
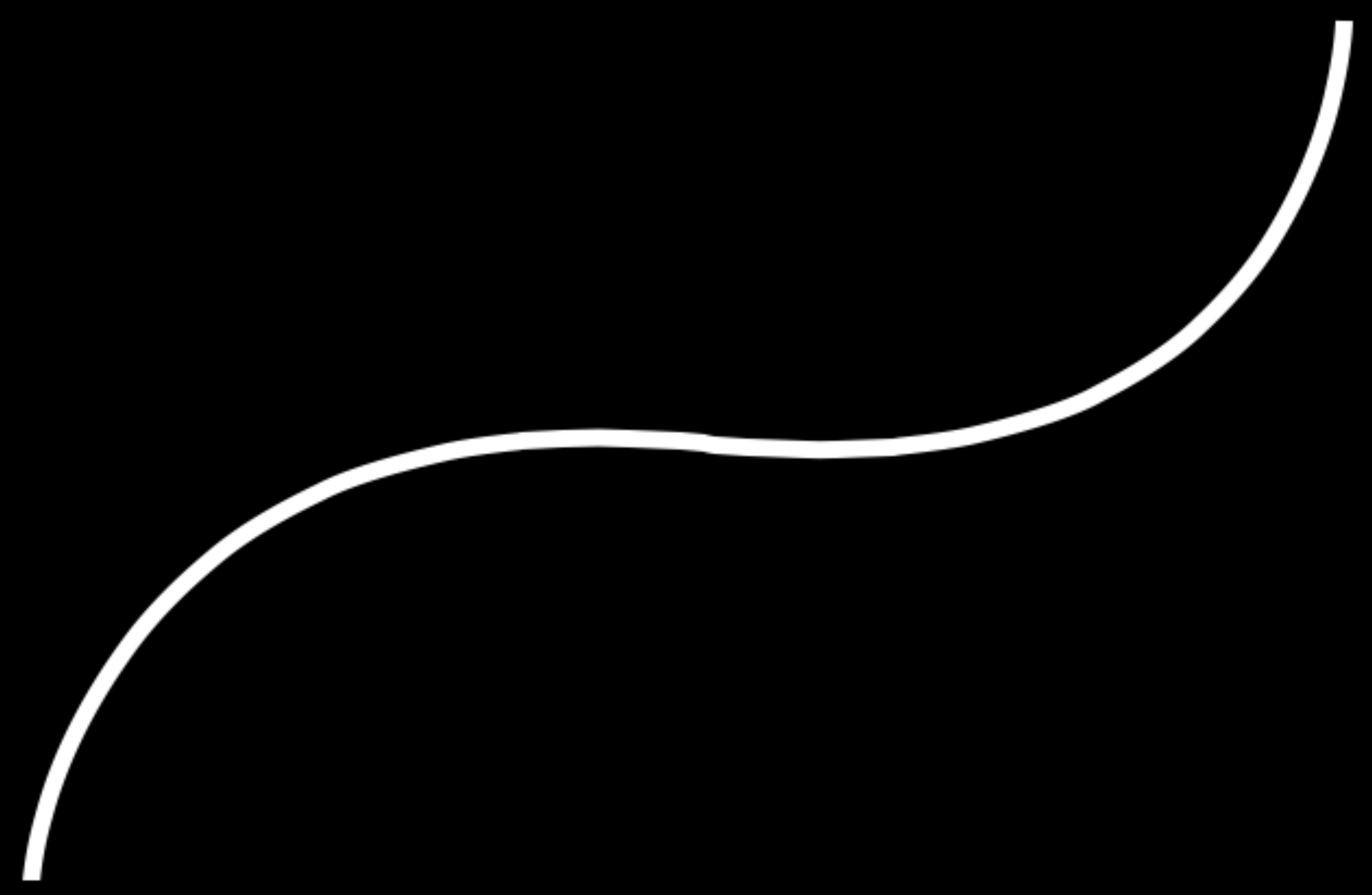


CAShapeLayer

Line

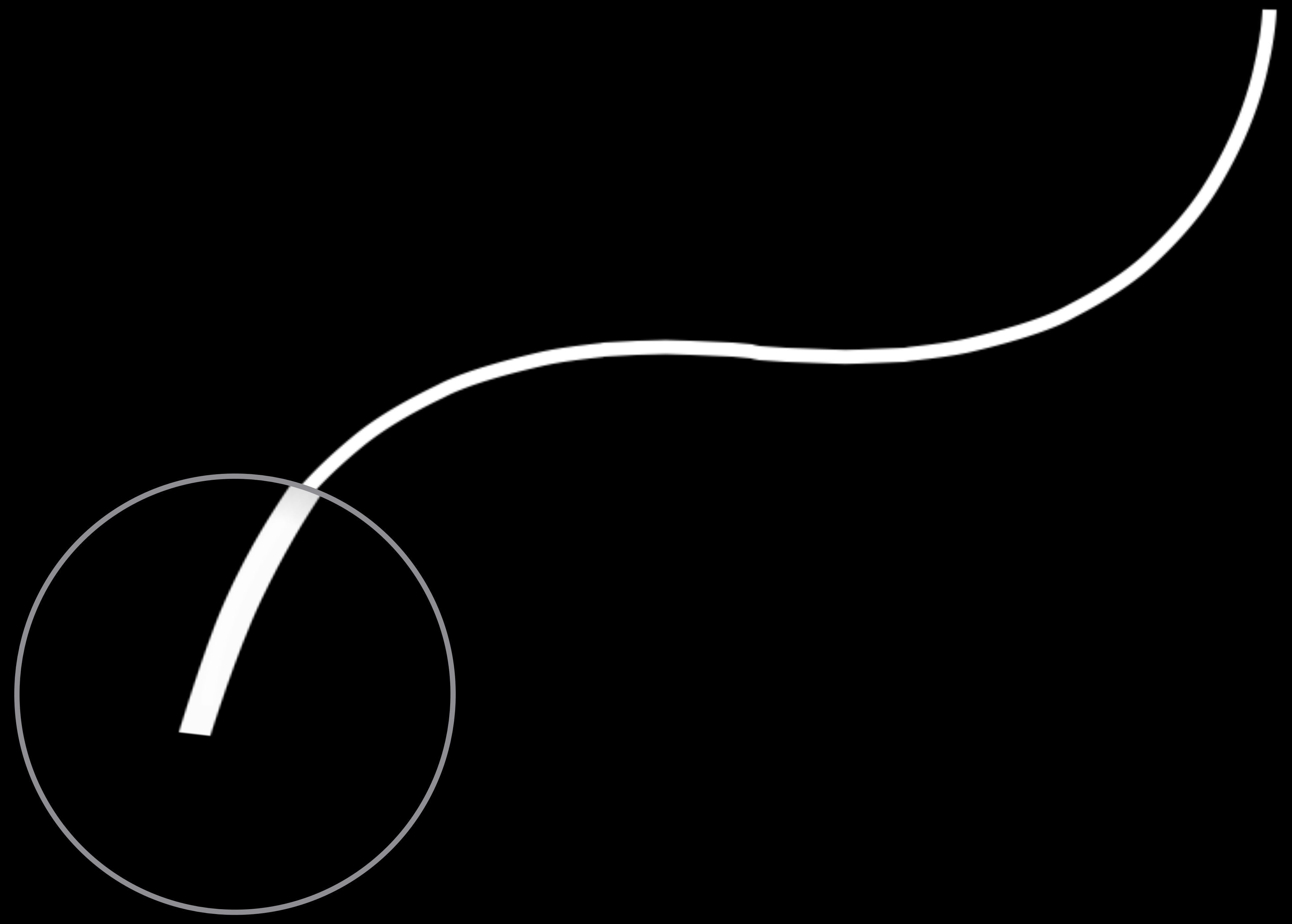
```
lineCap
lineDashPattern
lineDashPhase
```



CAShapeLayer

Line

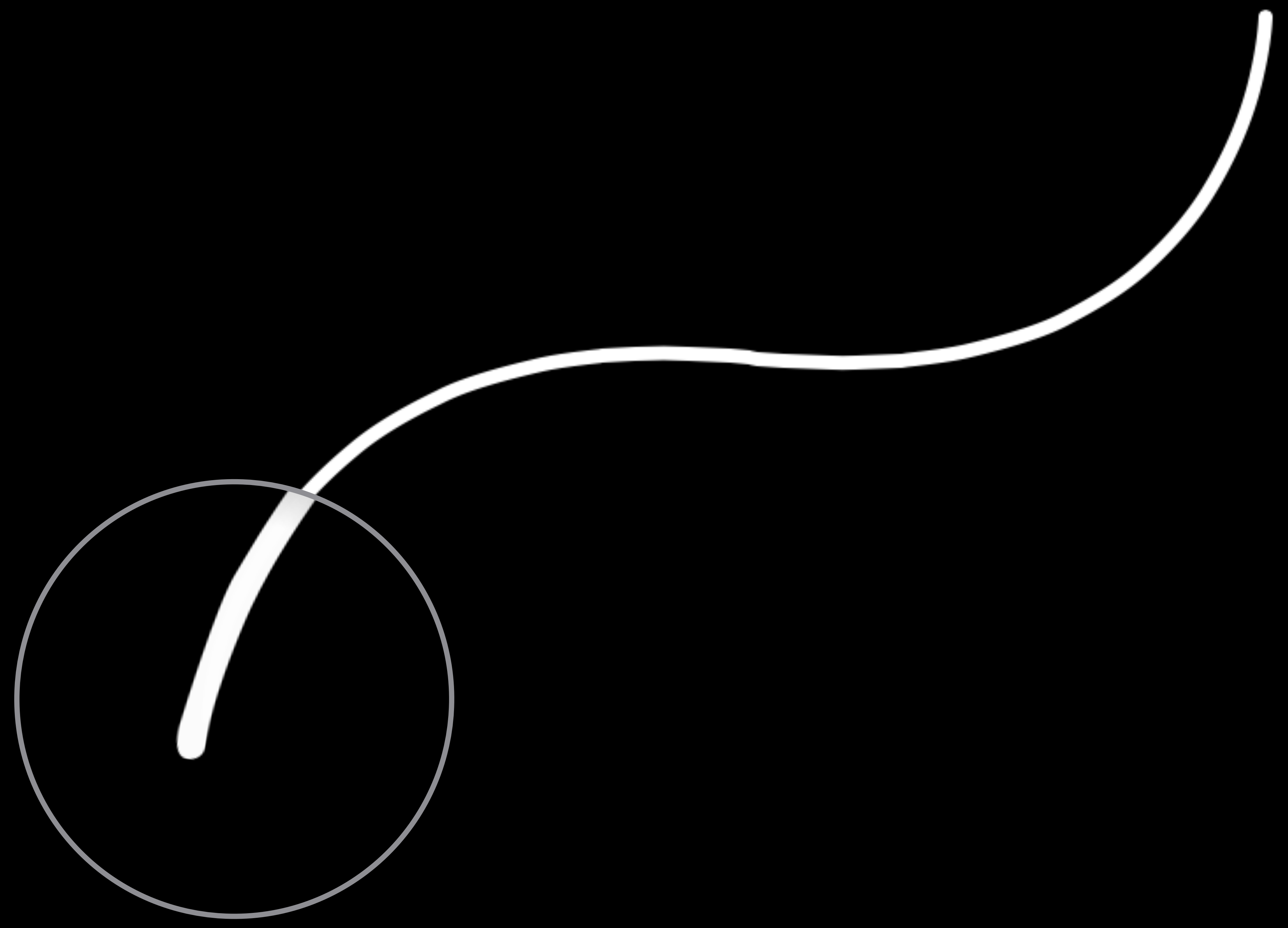
```
lineCap
lineDashPattern
lineDashPhase
```



CAShapeLayer

Line

lineCap
lineDashPattern
lineDashPhase

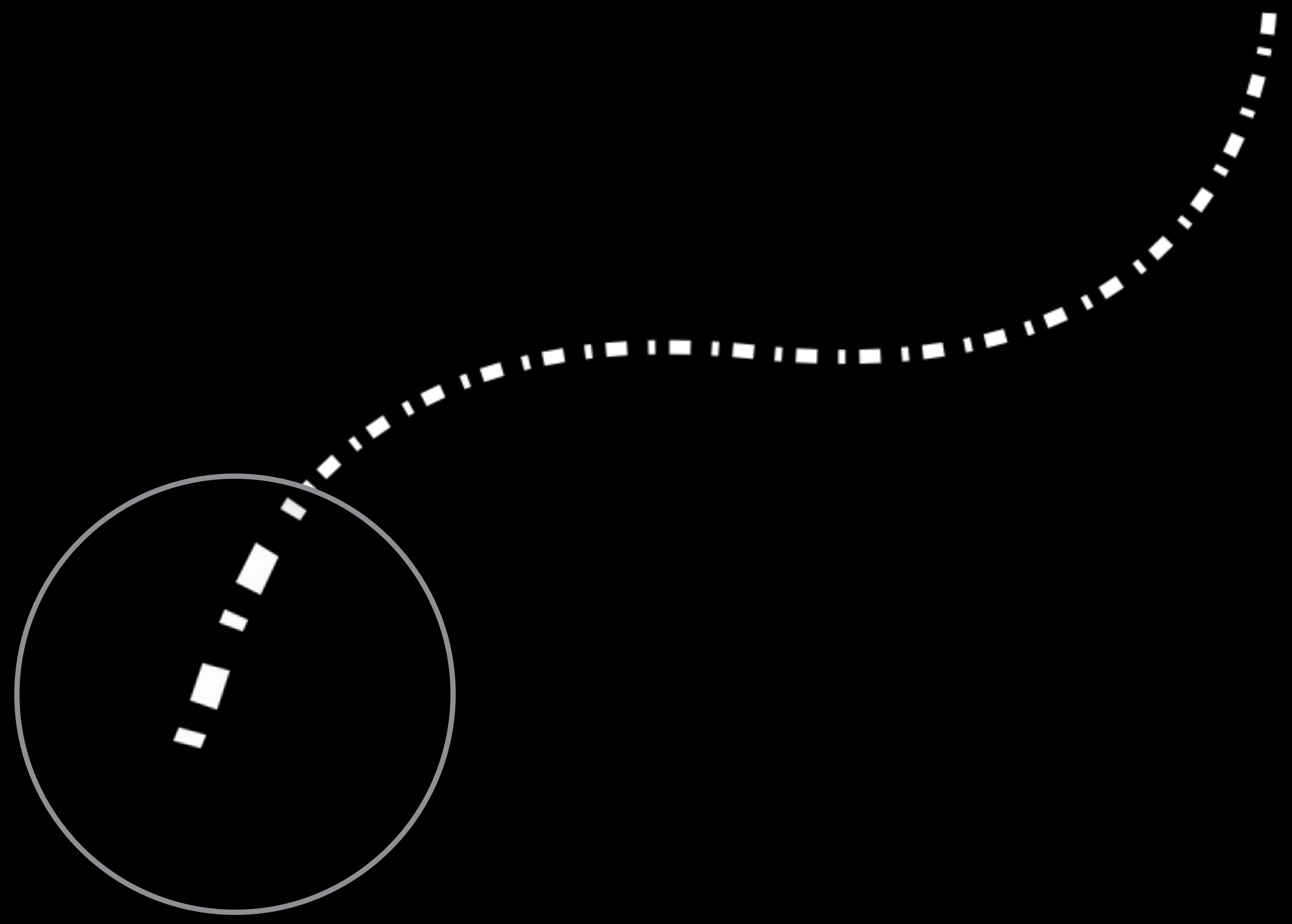


```
[shapeLayer setLineCap:kCALineCapRound]
```

CAShapeLayer

Line

lineCap
lineDashPattern
lineDashPhase



```
[shapeLayer setLineDashPattern:@[@2, @4, @6, @6]]
```

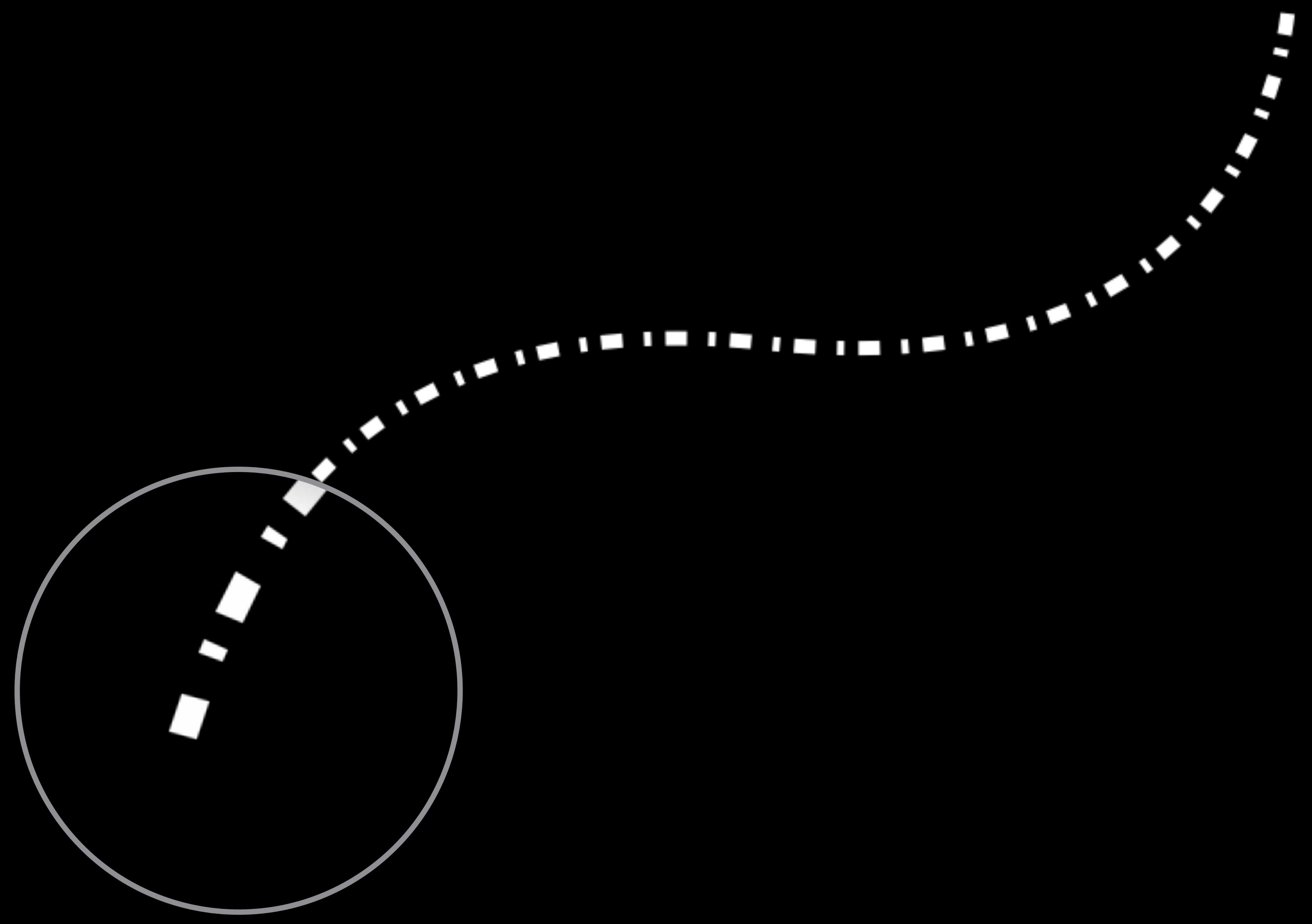
CAShapeLayer

Line

lineCap

lineDashPattern

lineDashPhase

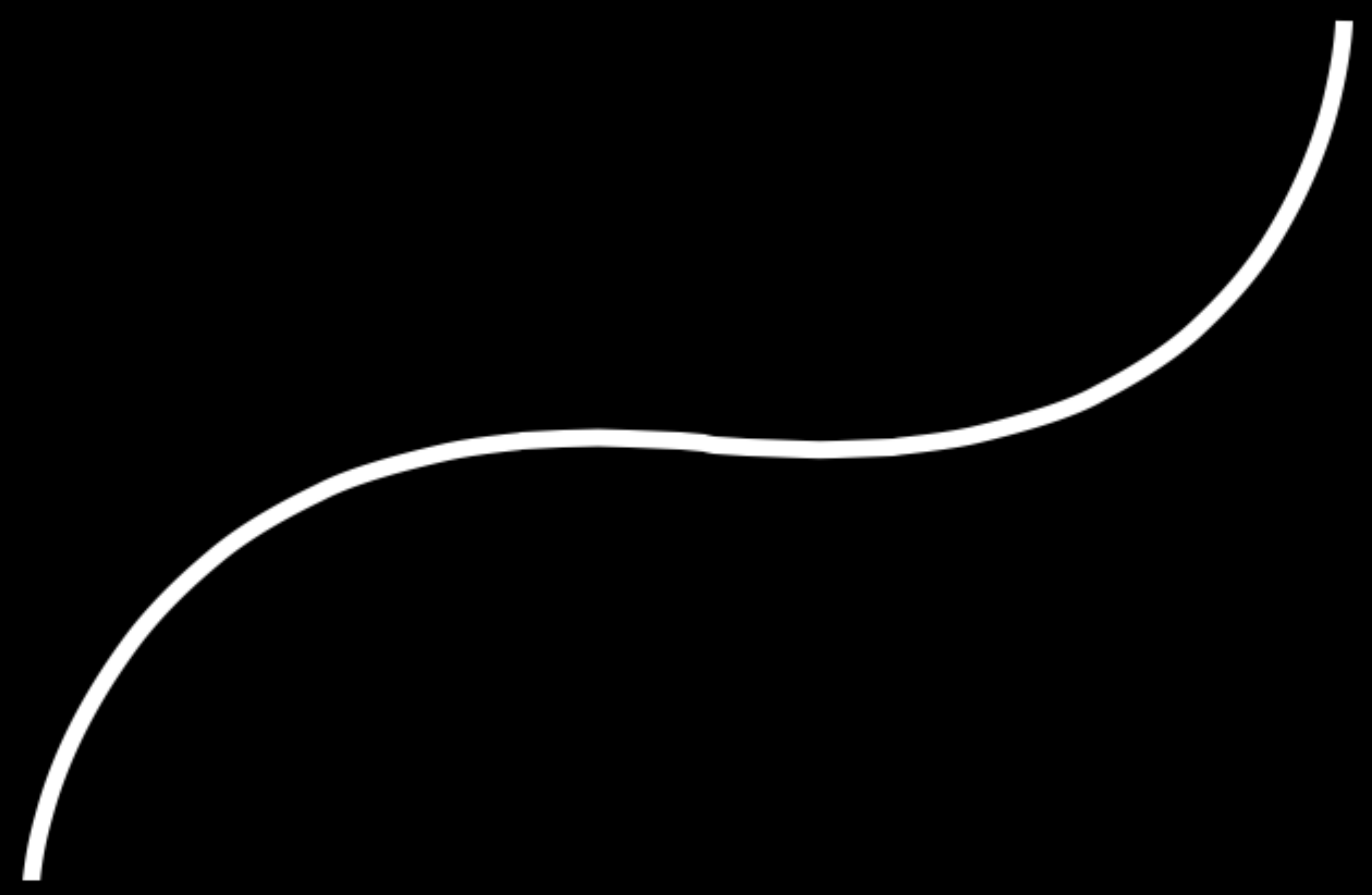


```
[shapeLayer setLineDashPattern:@[@2, @4, @6, @6]]
[shapeLayer setLineDashPhase:4.0]
```

CAShapeLayer

Stroke

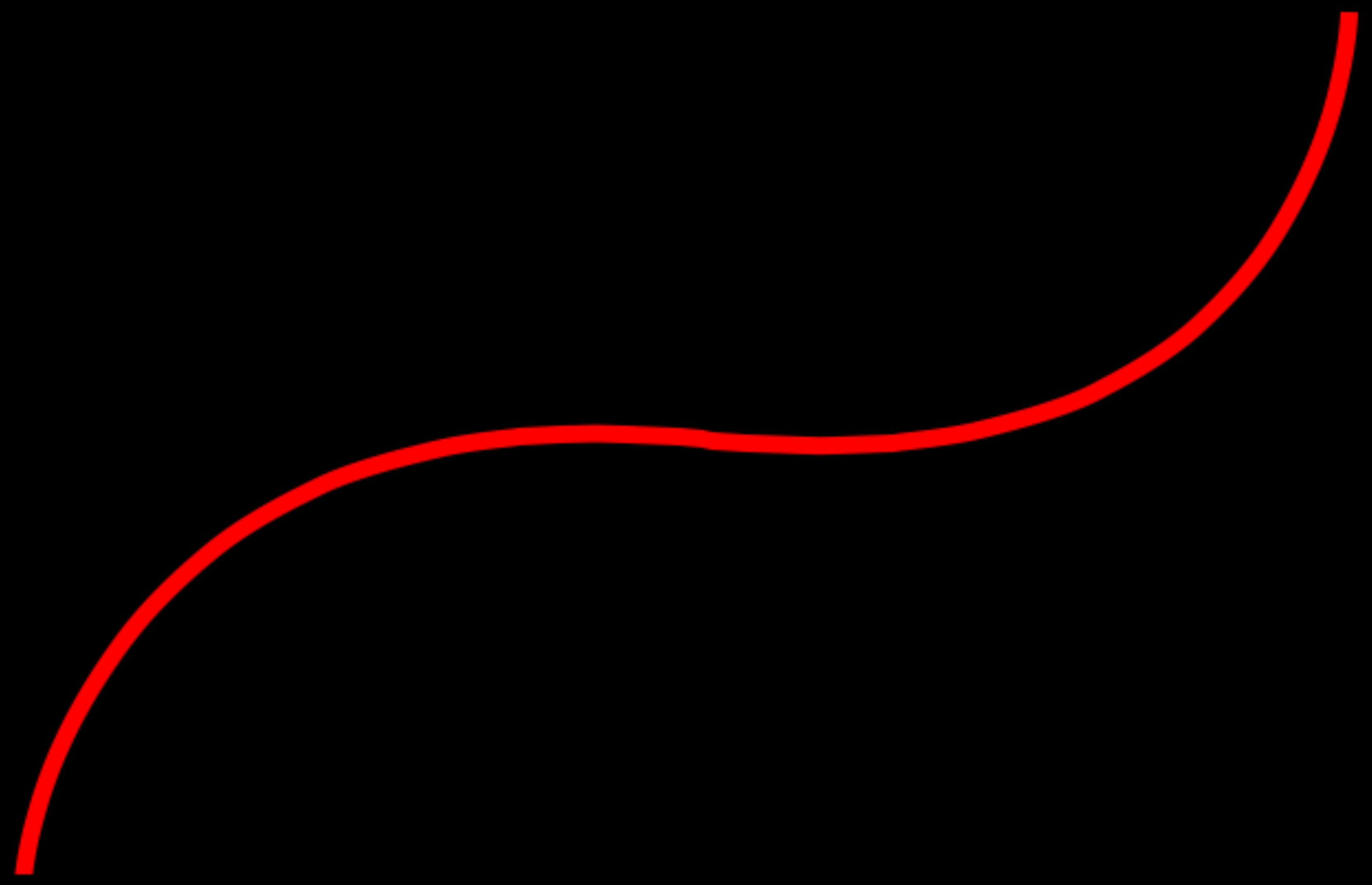
```
strokeColor
strokeBegin
strokeEnd
```



CAShapeLayer

Stroke

strokeColor
strokeBegin
strokeEnd

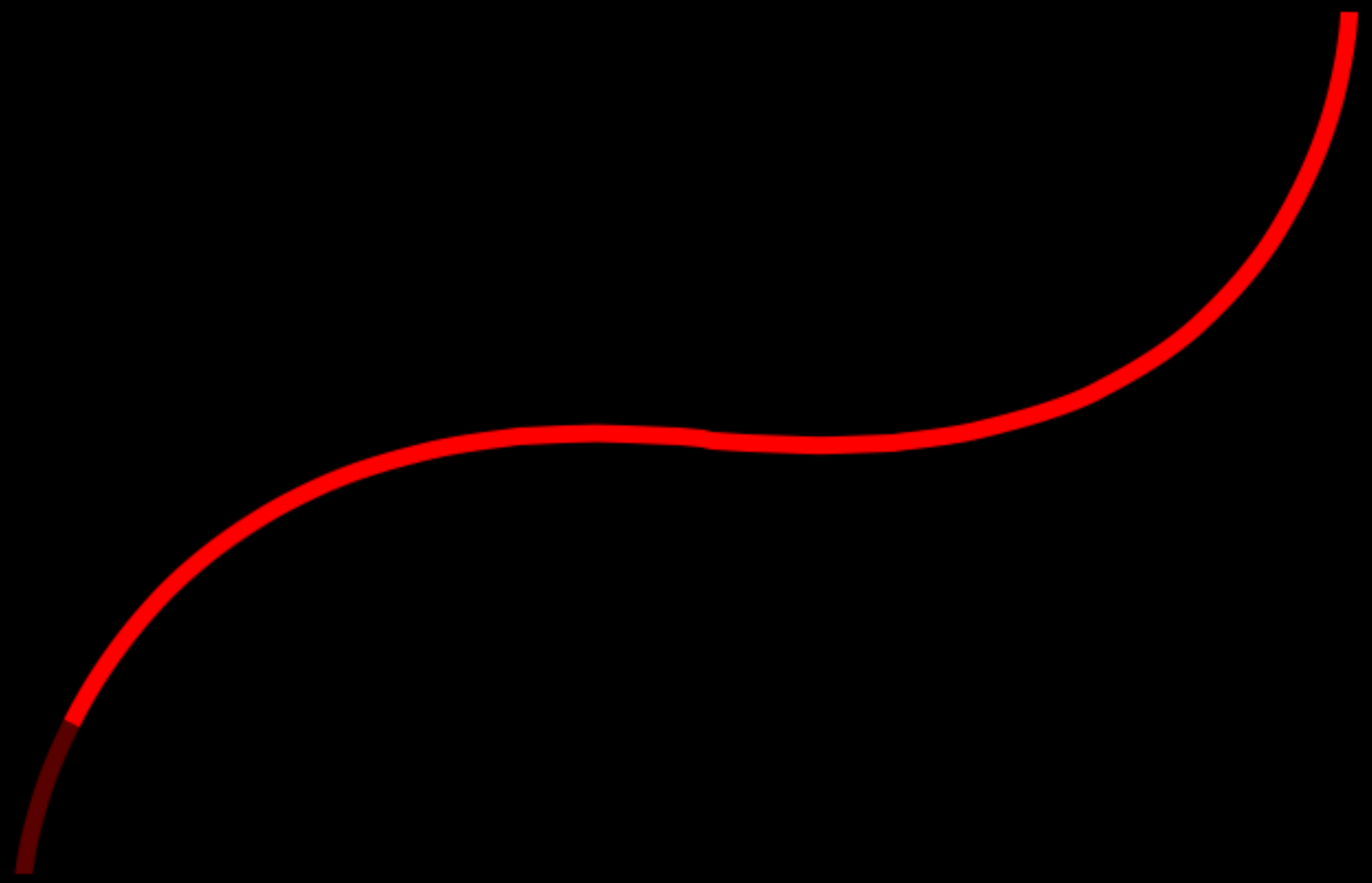


```
[shapeLayer setStrokeColor:[UIColor redColor].CGColor]
```

CAShapeLayer

Stroke

```
strokeColor
strokeBegin
strokeEnd
```

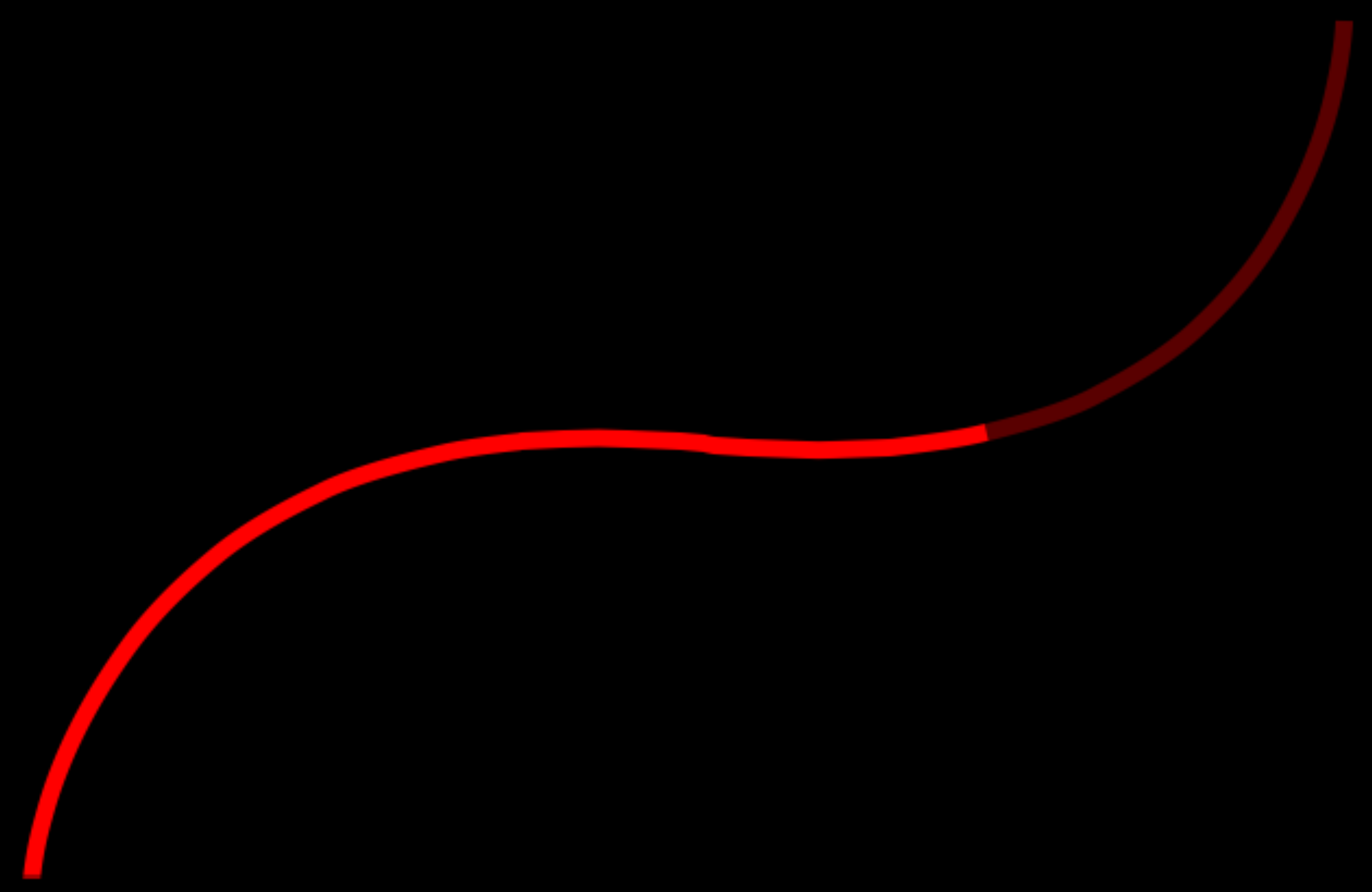


```
[shapeLayer setStrokeStart:0.2]
```

CAShapeLayer

Stroke

```
strokeColor
strokeBegin
strokeEnd
```

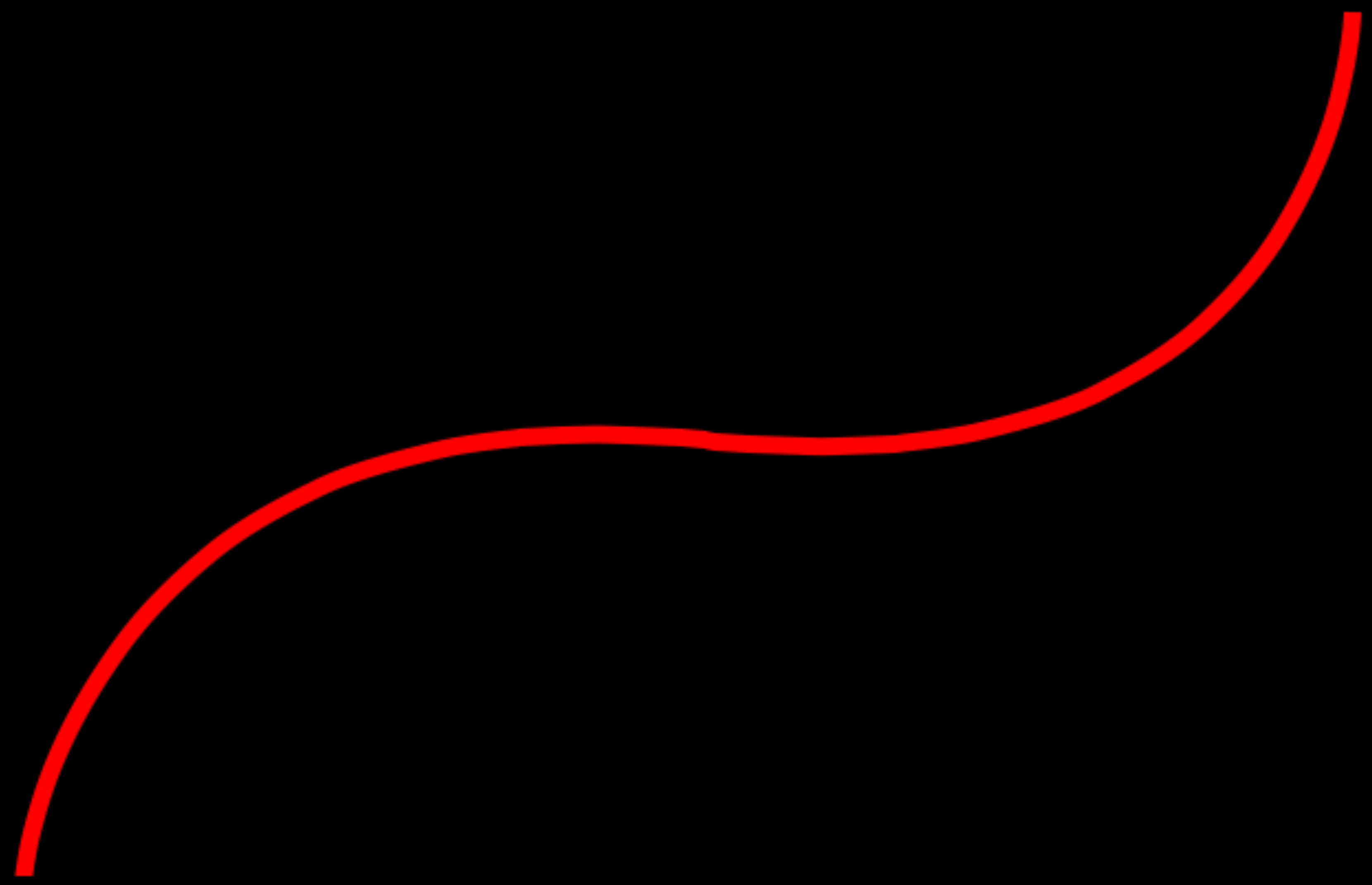


```
[shapeLayer setStrokeEnd:0.6]
```

CAShapeLayer

Fill

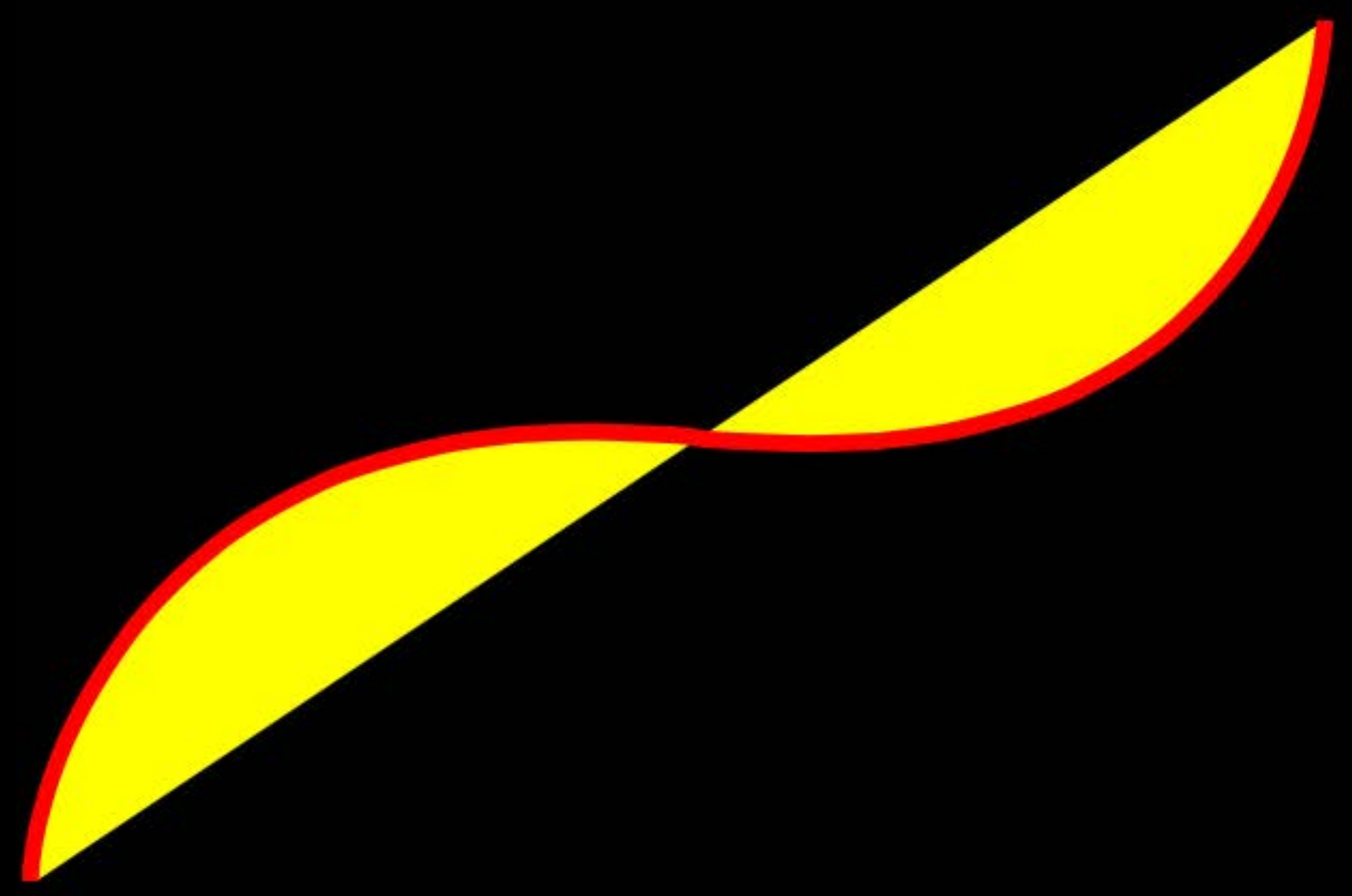
`fillColor`



CAShapeLayer

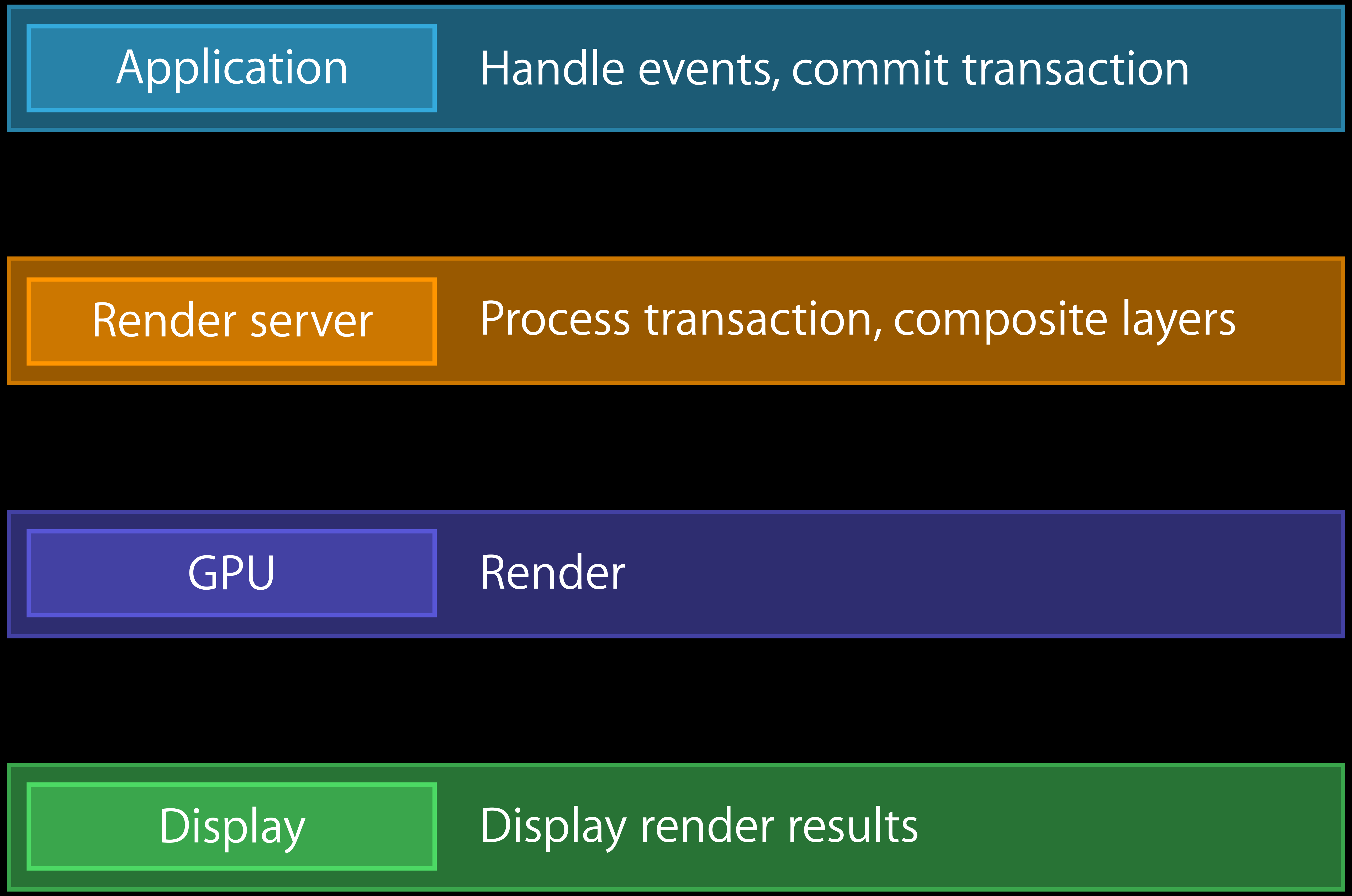
Fill

`fillColor`



```
[shapeLayer setFillColor:[UIColor yellowColor].CGColor]
```

Rendering Pipeline



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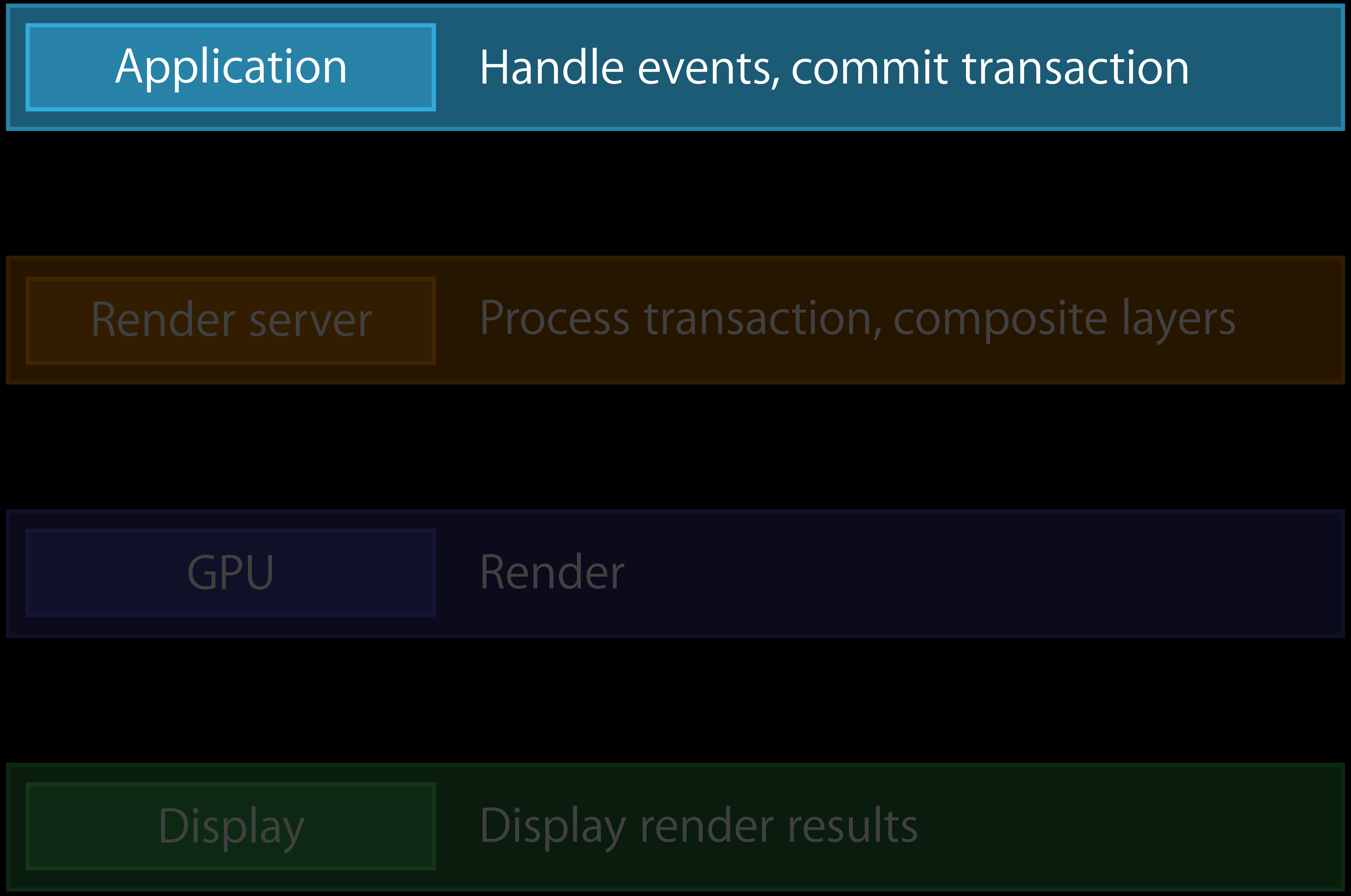
Rendering Pipeline



Application	Handle events, commit transaction
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CAShapeLayer

Rendering in your app

CAShapeLayer

Rendering in your app

Rasterizes shape layer on CPU

CAShapeLayer

Rendering in your app

Rasterizes shape layer on CPU

Sends rasterized layer to render server

CAShapeLayer

Rendering in your app

Rasterizes shape layer on CPU

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Can be expensive in CPU time

CAShapeLayer

Rendering in your app

Rasterizes shape layer on CPU

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Can be expensive in CPU time

Use more layers with less complexity

CAShapeLayer

Rendering in your app

Rasterizes shape layer on CPU

Sends rasterized layer to render server

Can be expensive in CPU time

Use more layers with less complexity

Be cautious about frequent changes

Demo

CAShapeLayer

Dynamic Core Animation Behaviors

Modifying implicit animations

Dynamic Core Animation Behaviors

Did you know?

Dynamic Core Animation Behaviors

Did you know?

UIKit supports most animations

Dynamic Core Animation Behaviors

Did you know?

UIKit supports most animations

Core Animation provides implicit animations on layers

Dynamic Core Animation Behaviors

Did you know?

UIKit supports most animations

Core Animation provides implicit animations on layers

Have the ability to override implicit Core Animation behaviors

Dynamic Core Animation Behaviors

What could you do?

Dynamic Core Animation Behaviors

What could you do?

Disable implicit animations

Dynamic Core Animation Behaviors

What could you do?

Disable implicit animations

Changing the behavior of default animations

Dynamic Core Animation Behaviors

What could you do?

Disable implicit animations

Changing the behavior of default animations

- Show a color while animating opacity

Dynamic Core Animation Behaviors

What could you do?

Disable implicit animations

Changing the behavior of default animations

- Show a color while animating opacity
- Use a non-linear path for changing position

Dynamic Core Animation Behaviors

What could you do?

Disable implicit animations

Changing the behavior of default animations

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Animating new properties on a custom CALayer

Dynamic Core Animation Behaviors

What could you do?

Disable implicit animations

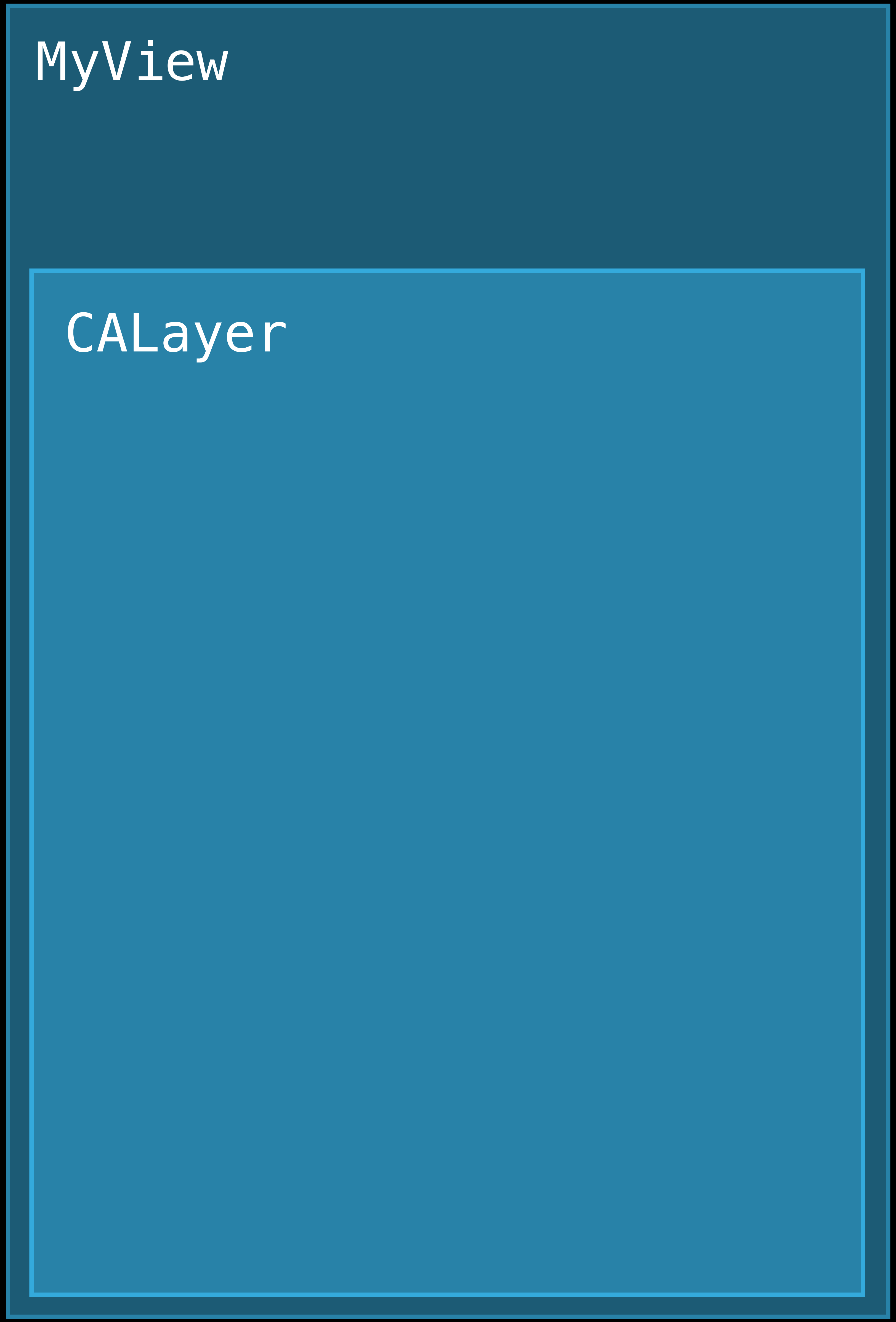
Changing the behavior of default animations

- Show a color while animating opacity
- Use a non-linear path for changing position

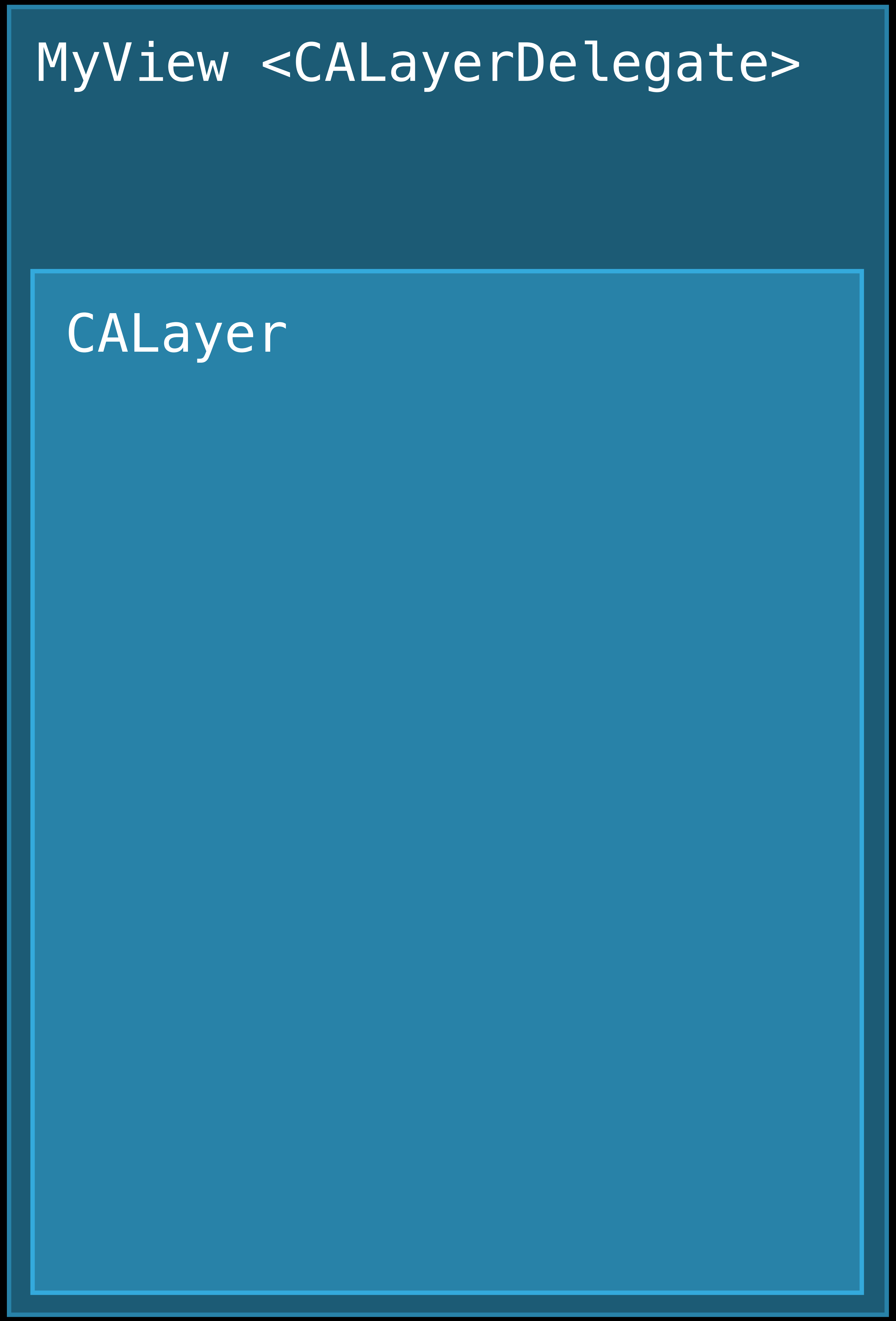
Animating new properties on a custom CALayer

Define behaviors that are inherent to a custom view

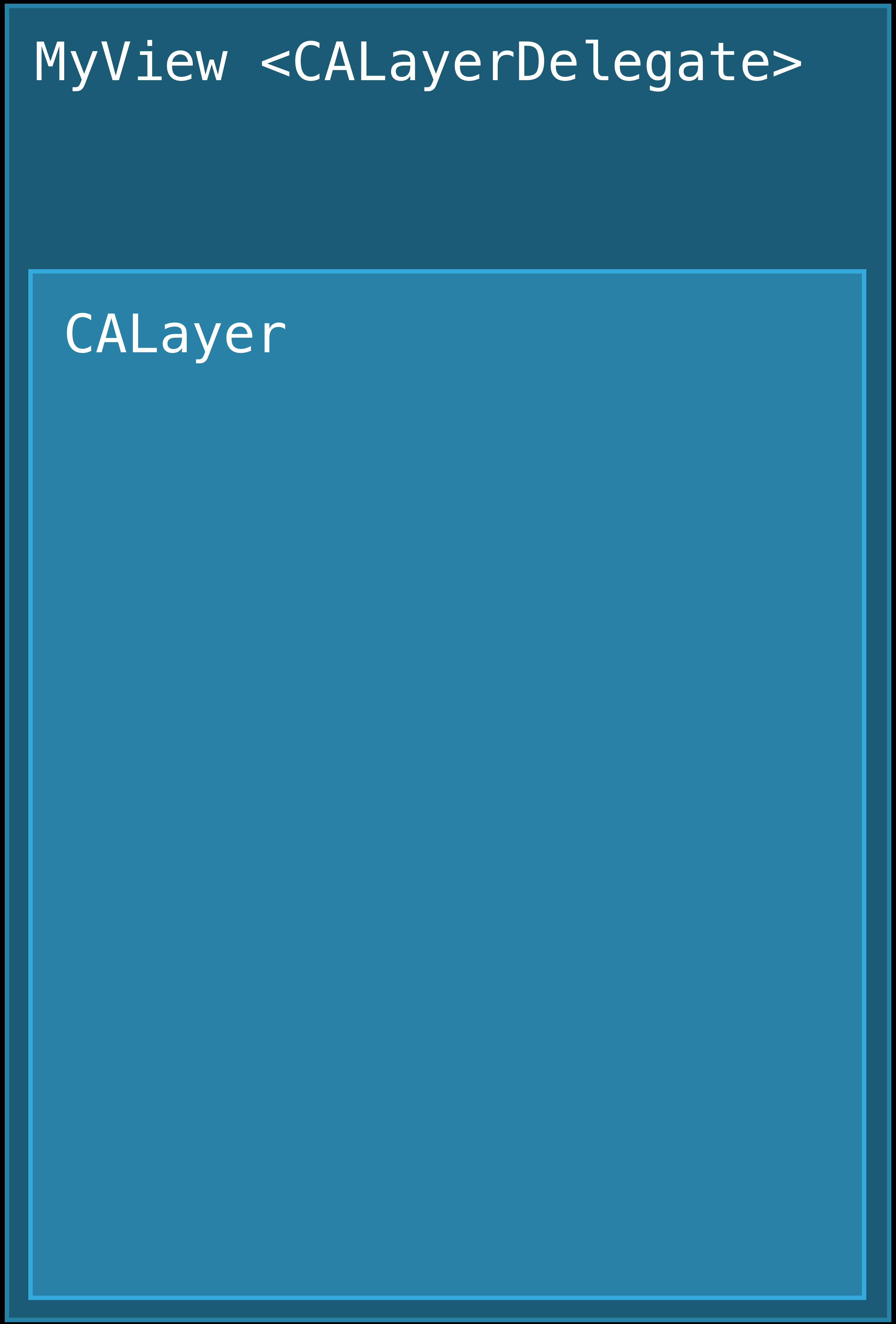
Dynamic Core Animation Behaviors



Dynamic Core Animation Behaviors



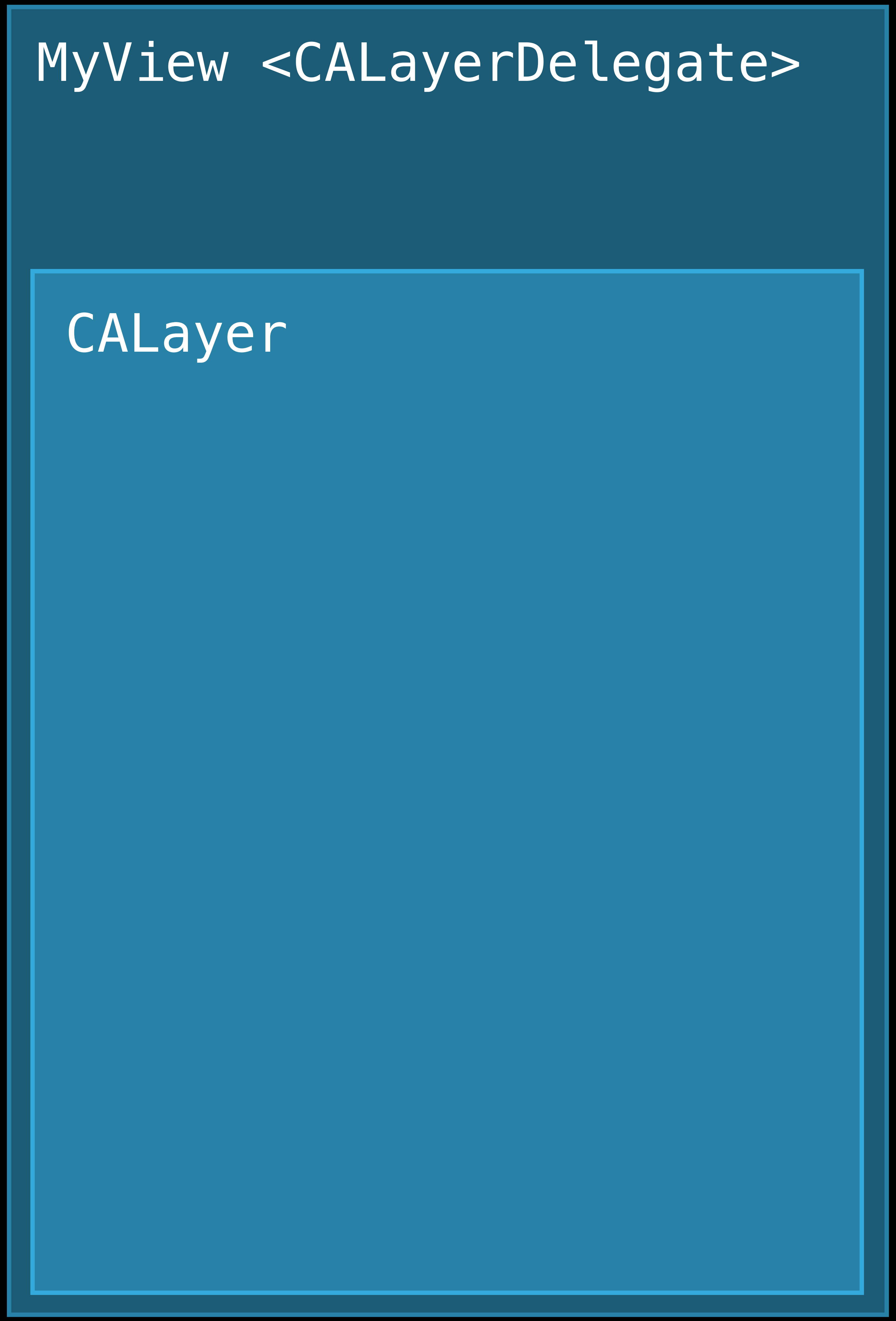
Dynamic Core Animation Behaviors



MyView <CALayerDelegate>

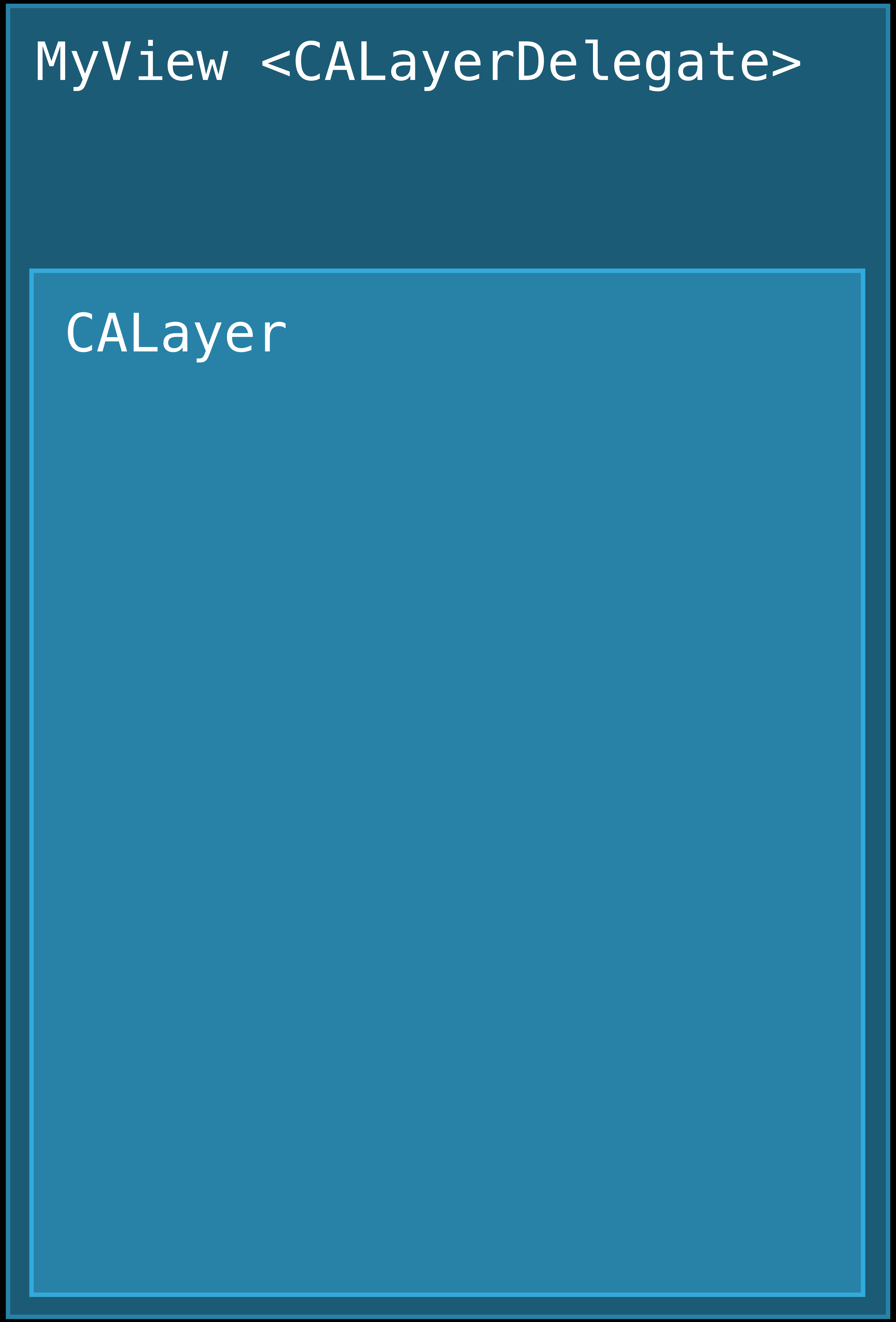
CALayer

Dynamic Core Animation Behaviors



```
[UIView animateWithDuration:1.0 animations:^{
    [MyView setAlpha:0.2];
};
```

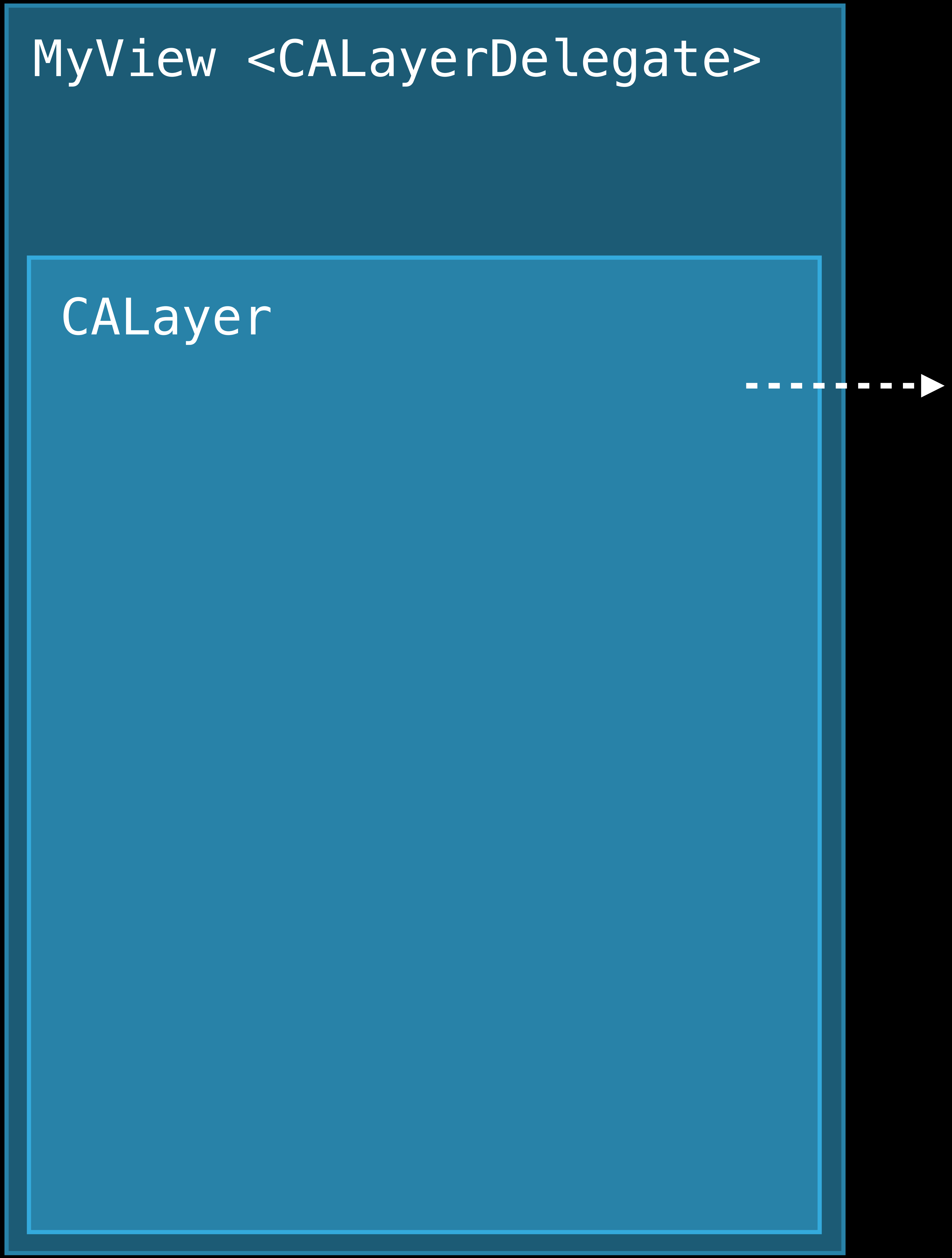
Dynamic Core Animation Behaviors



MyView <CALayerDelegate>

CALayer

Dynamic Core Animation Behaviors

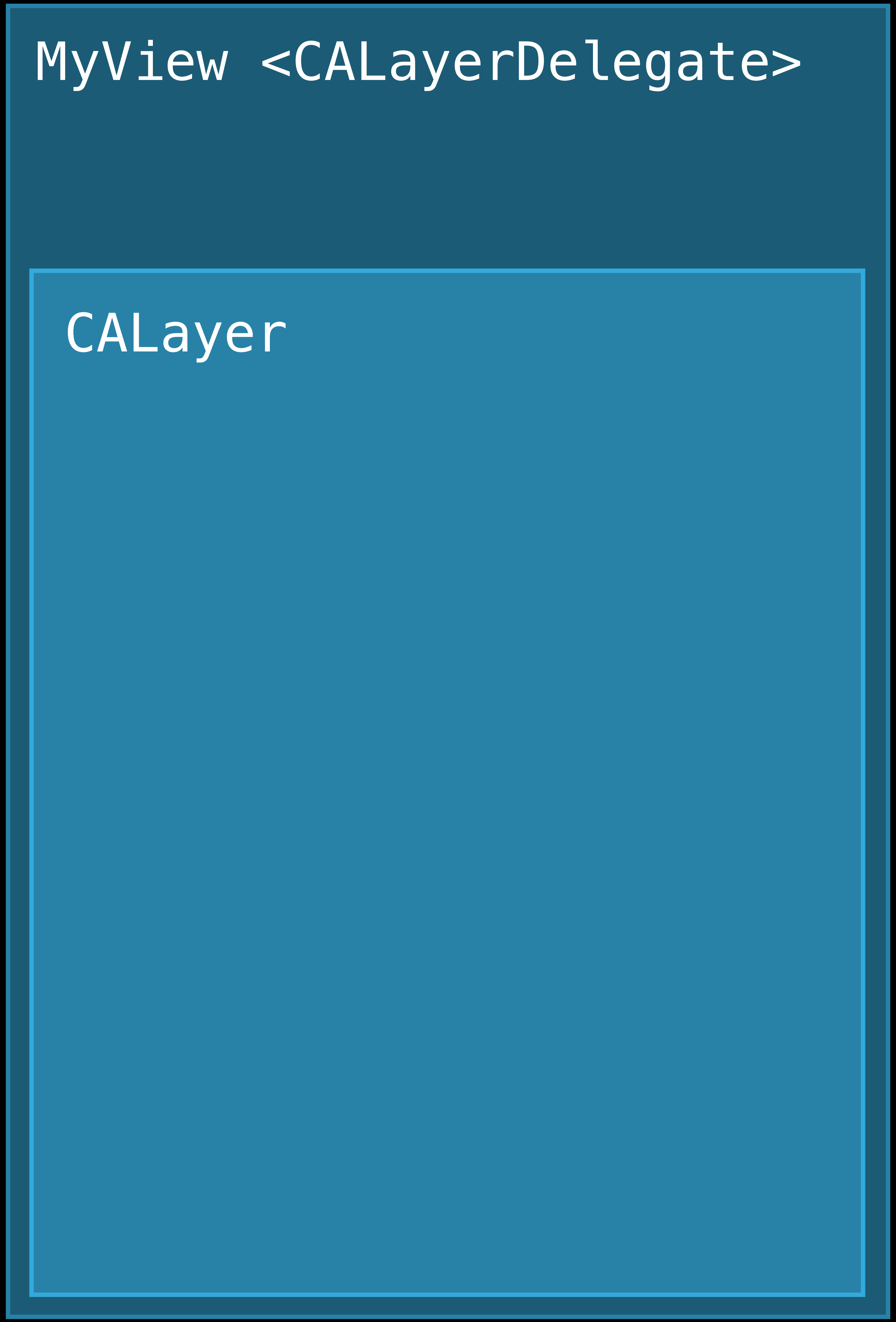


MyView <CALayerDelegate>

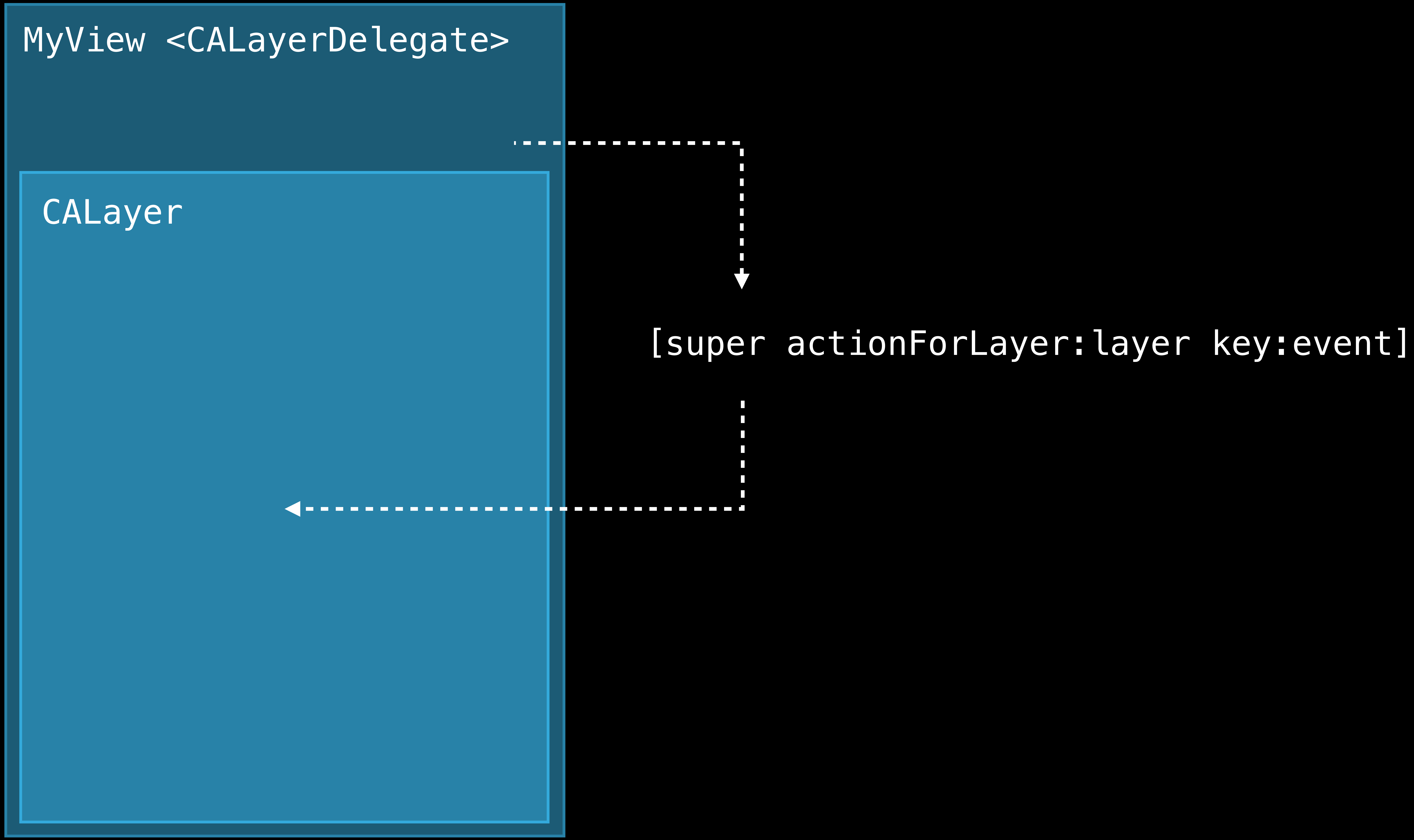
CALayer

– (id<CAAction>)actionForLayer:forKey:

Dynamic Core Animation Behaviors



Dynamic Core Animation Behaviors

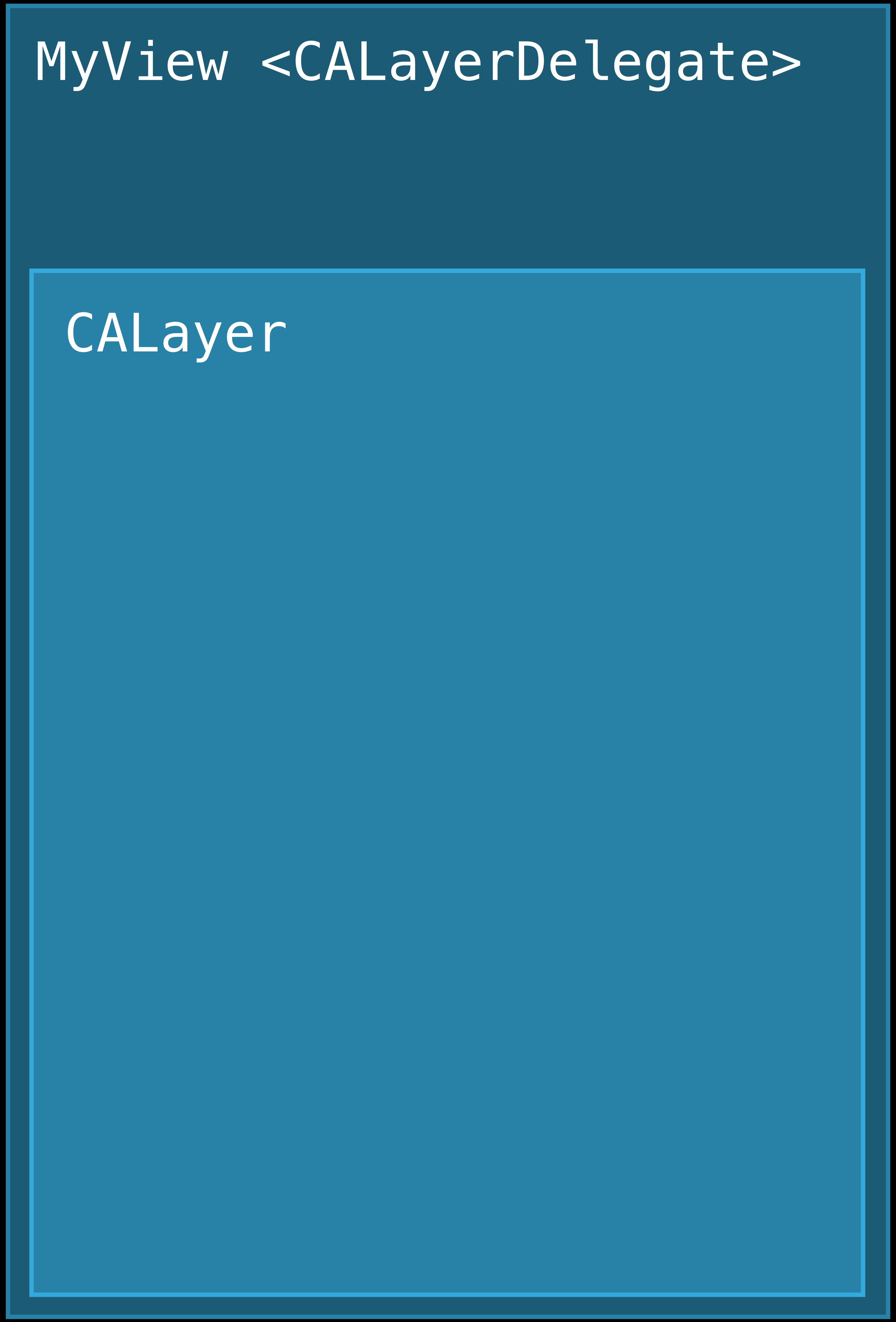


MyView <CALayerDelegate>

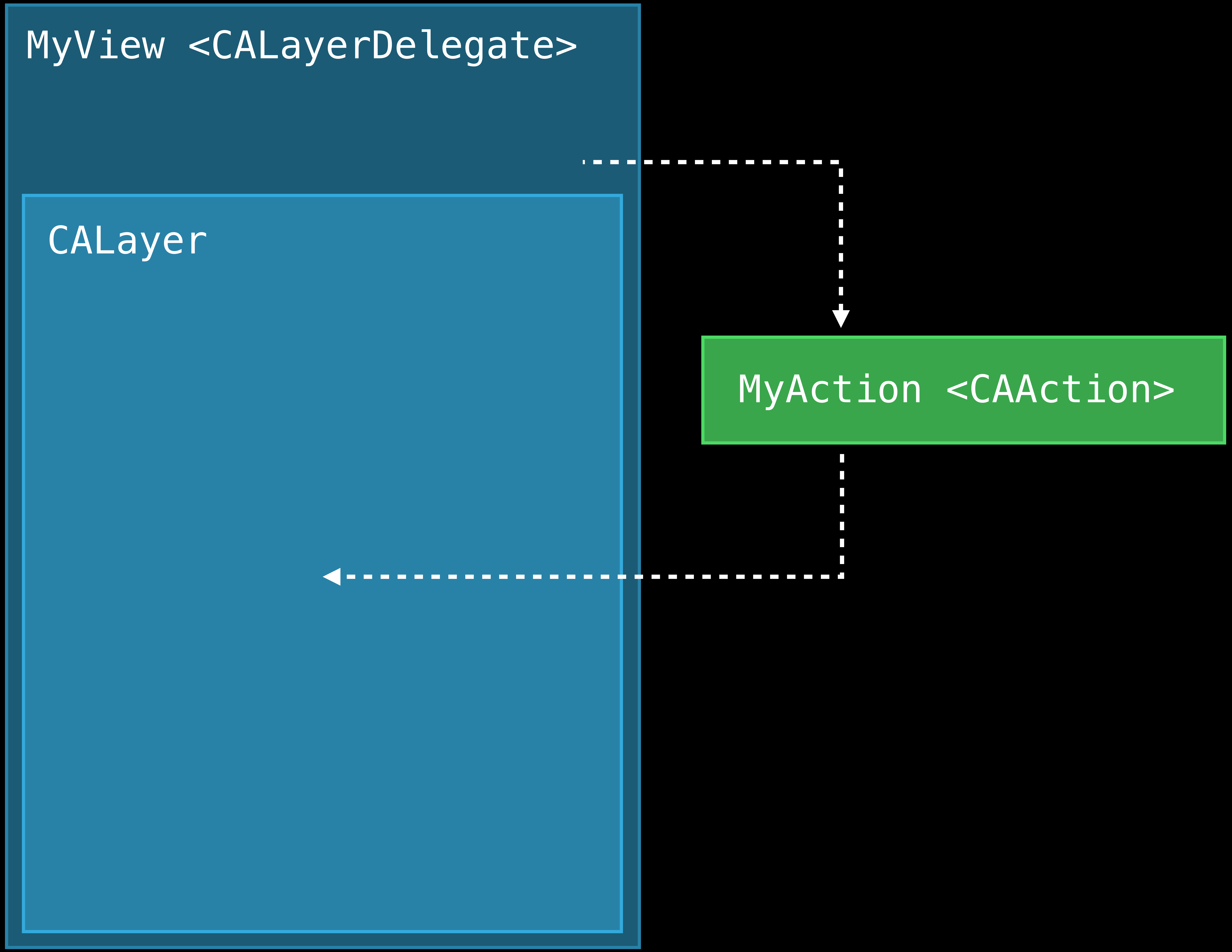
CALayer

[super actionForLayer:layer key:event]

Dynamic Core Animation Behaviors



Dynamic Core Animation Behaviors



Dynamic Core Animation Behaviors

CAAction protocol

```
- (void)runActionForKey:(NSString *)key object:(id)anObject arguments:
(NSDictionary *)dict
```

Dynamic Core Animation Behaviors

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Implement CAAction on any object

Dynamic Core Animation Behaviors

CAAction protocol

```
- (void)runActionForKey:(NSString *)key object:(id)anObject arguments:
(NSDictionary *)dict
```

Implement CAAction on any object

Perform animations in the implementation

Dynamic Core Animation Behaviors

CAAction protocol

```
- (void)runActionForKey:(NSString *)key object:(id)anObject arguments:
(NSDictionary *)dict
```

Specifies the property that has changed

Dynamic Core Animation Behaviors

CAAction protocol

```
- (void)runActionForKey:(NSString *)key object:(id)anObject arguments:
(NSDictionary *)dict
```

Provides a reference to the layer being animated

Demo

CAAction

Summary

Summary

Spring animations

Summary

Spring animations

UIVisualEffectView

Summary

Spring animations

UIVisualEffectView

CAShapeLayer

Summary

Spring animations

UIVisualEffectView

CAShapeLayer

Dynamic Core Animation behaviors

More Information

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App Frameworks Evangelist
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Documentation
UIKit Framework Reference
Core Animation Programming Guide
http://developer.apple.com

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

Related Sessions

🔵	Accessibility on iOS	Russian Hill	Tuesday 3:15PM
🔵	Advanced Topics in Internationalization	Russian Hill	Tuesday 9:00AM
🟠	Localizing with Xcode 6	Marina	Tuesday 11:30AM
🟠	Advanced Graphics and Animations for iOS App	Russian Hill	Tuesday 10:15AM
🔵	Building Interruptible and Responsive Interactions	Presidio	Friday 11:30AM

Labs

Visual Effects and Appearance Customization Lab	Frameworks Lab A	Friday 9:00AM
Dynamics, View Animations, and Core Animation Lab	Frameworks Lab A	Thursday 9:00AM

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