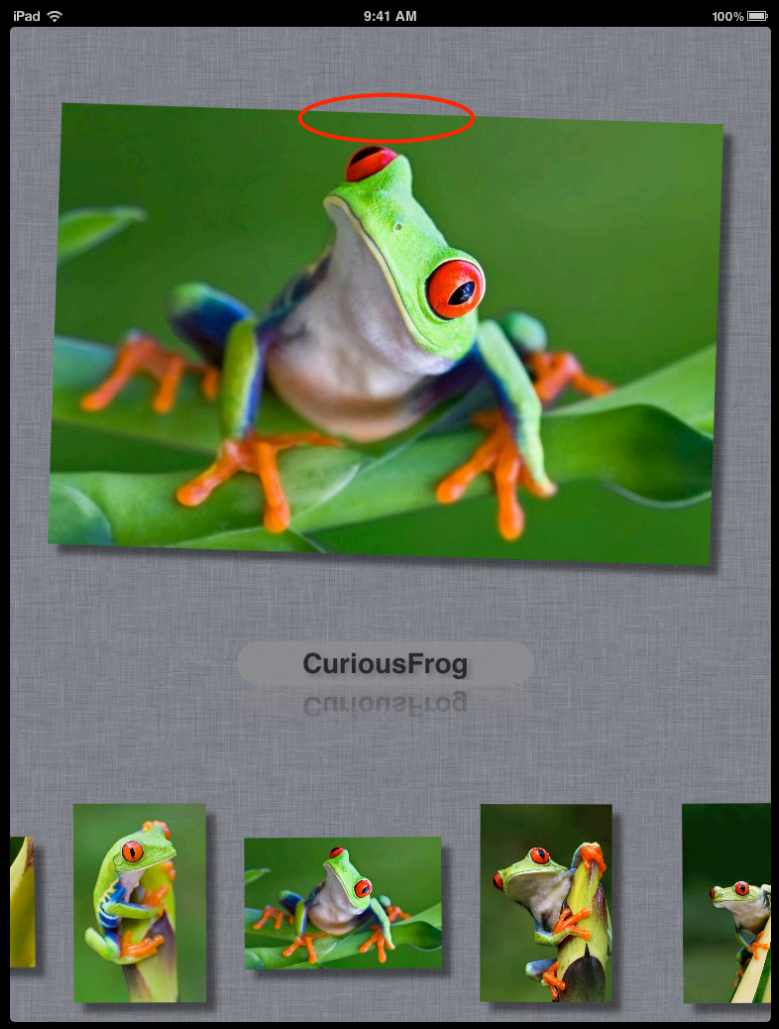
Understanding UIKit Rendering

Session 121

Josh Shaffer, Mathieu Martin and Andy Matuschak
iOS Frameworks

These are confidential sessions—please refrain from streaming, blogging, or taking pictures

Understanding UIKit Rendering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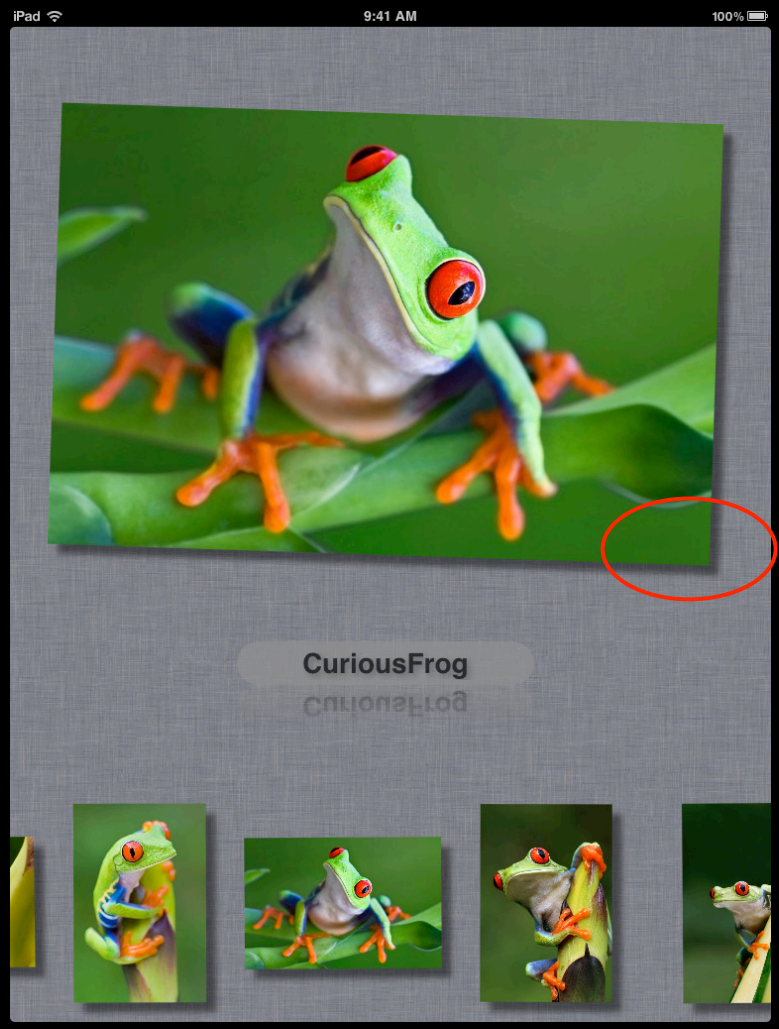
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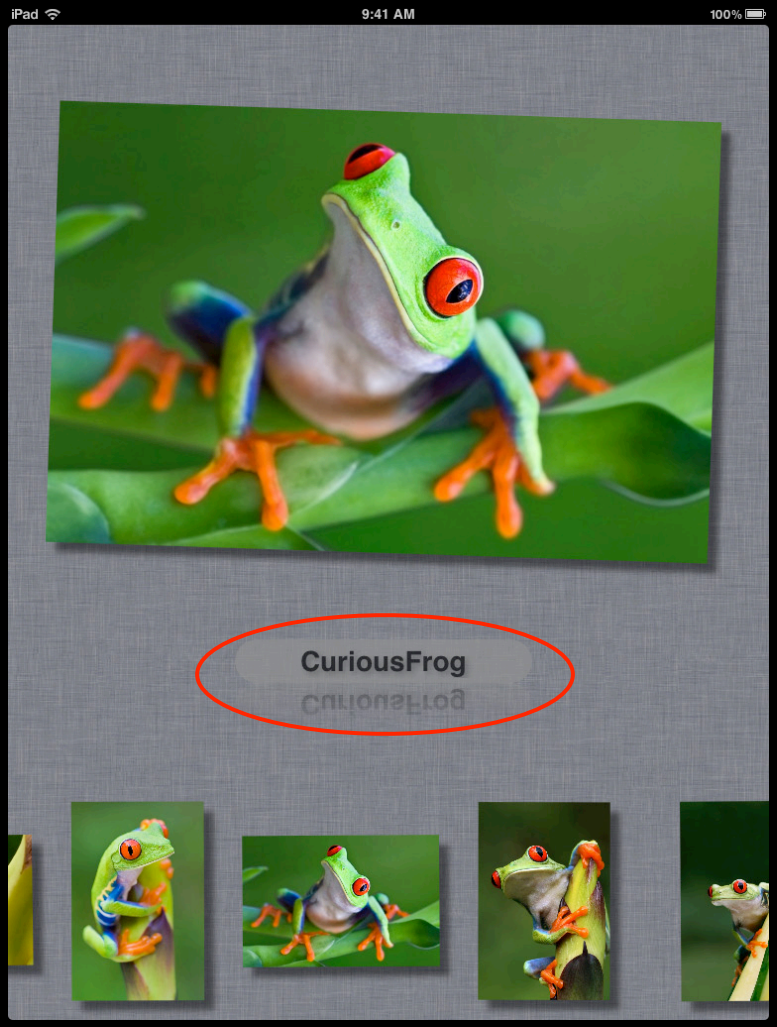
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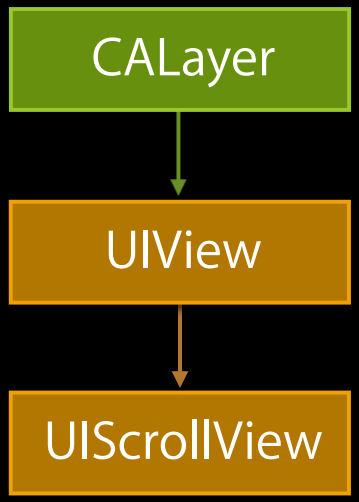
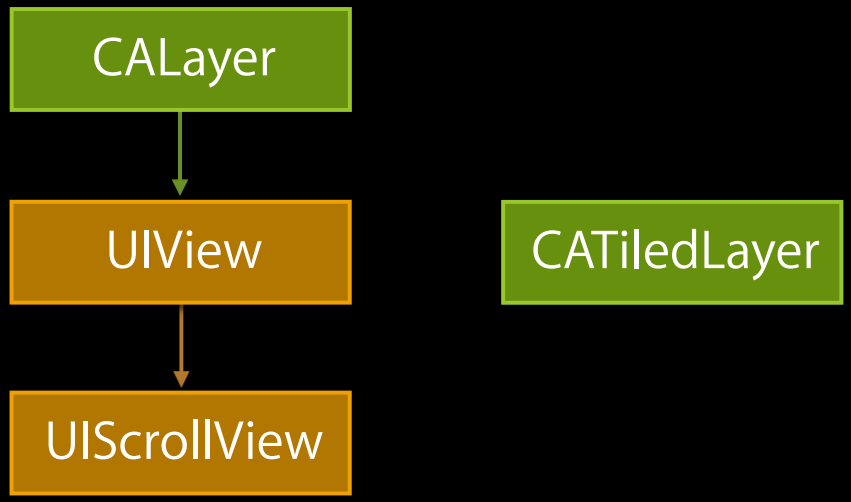
Understanding UIKit Rendering

- UIView and CALayer
- CATransaction and when views get rendered
- Quality and Performance
  - Clipping and masking
  - Edge anti-aliasing
  - Group opacity
  - Shadows

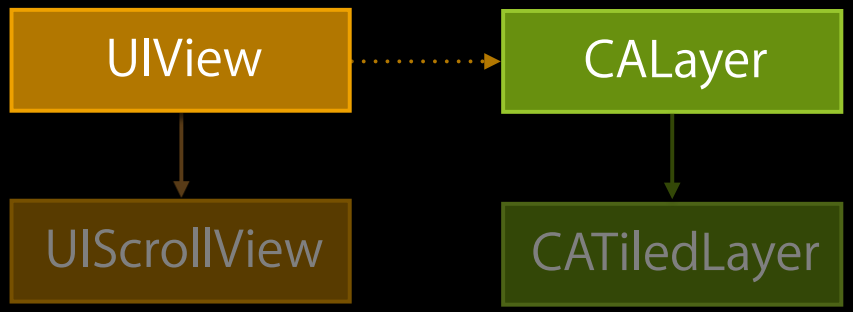
UIView/CALayer Relationship



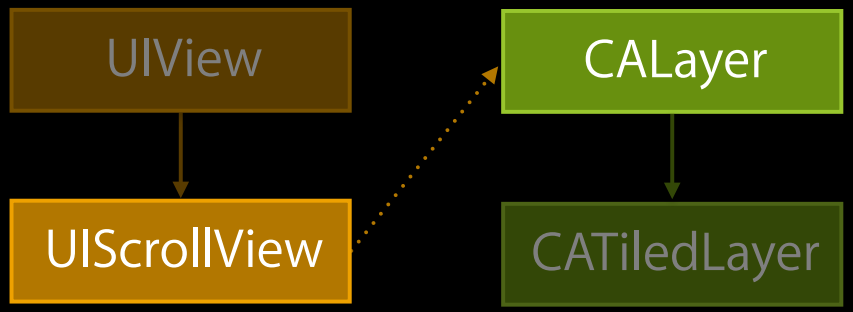
UIView/CALayer Relationship



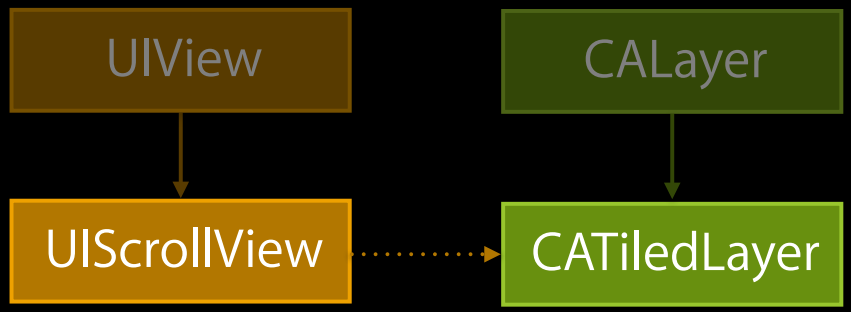
UIView/CALayer Relationship



UIView/CALayer Relationship



UIView/CALayer Relationship



UIView and CALayer

Geometry

Geometry of an iPhone 4

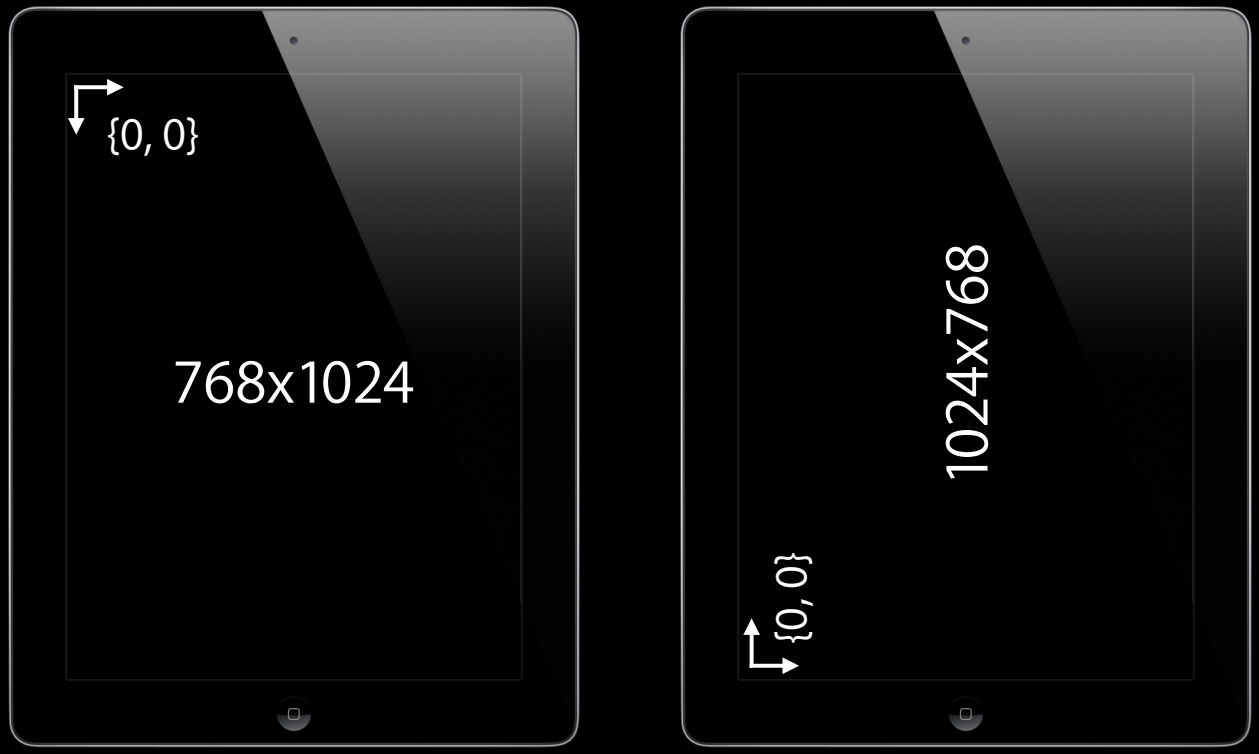
Geometry of an iPhone 4

Geometry of an iPhone 4

UIKit

CoreAnimation

Geometry of an iPad 2

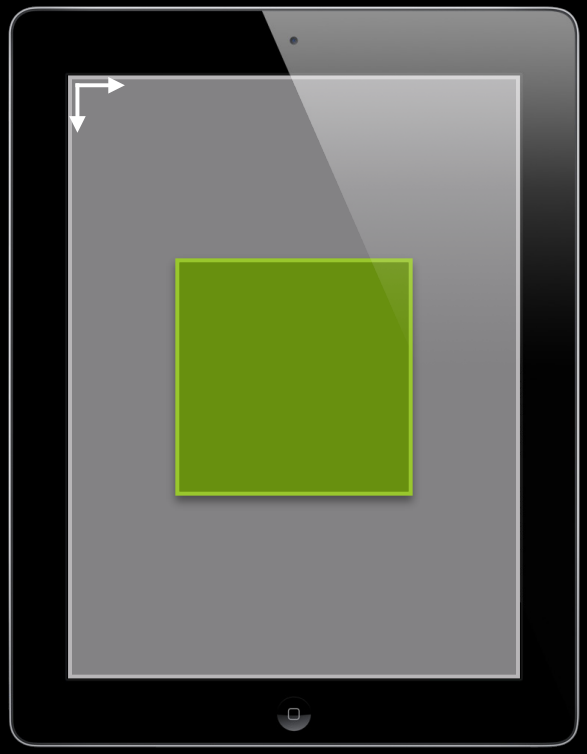


UIKit

CoreAnimation

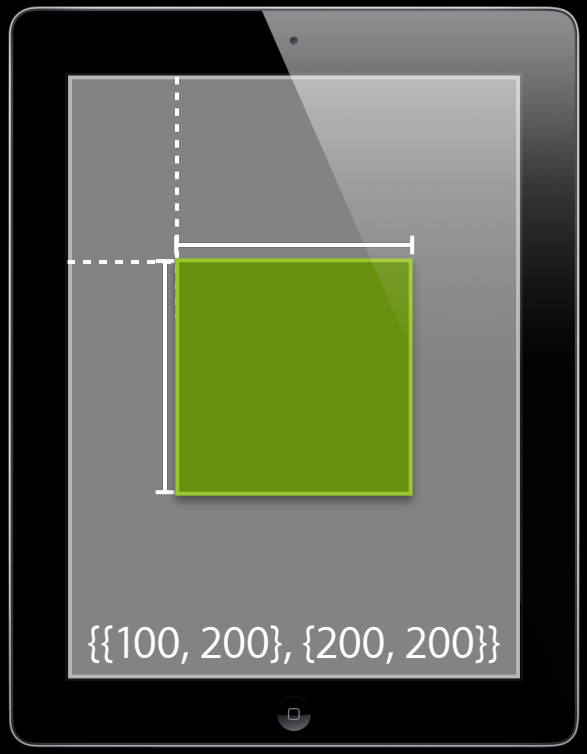
Geometry

Positioning and Sizing a View



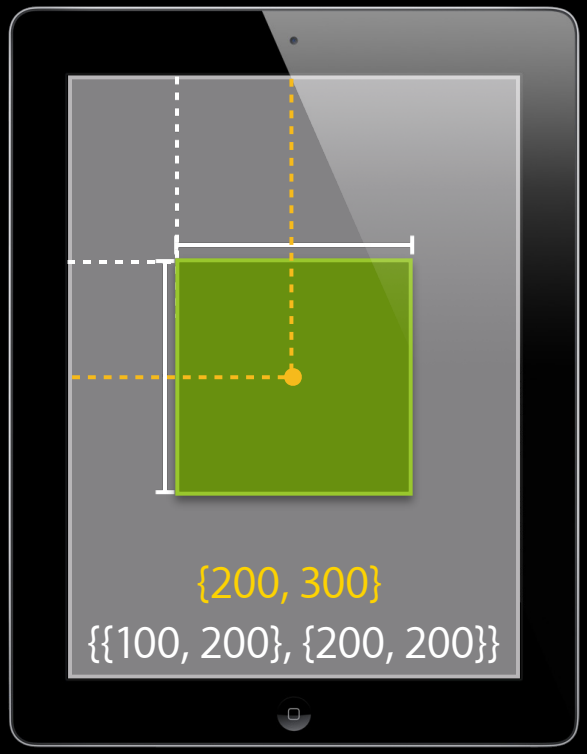
Frame

Superview's Coordinate Space



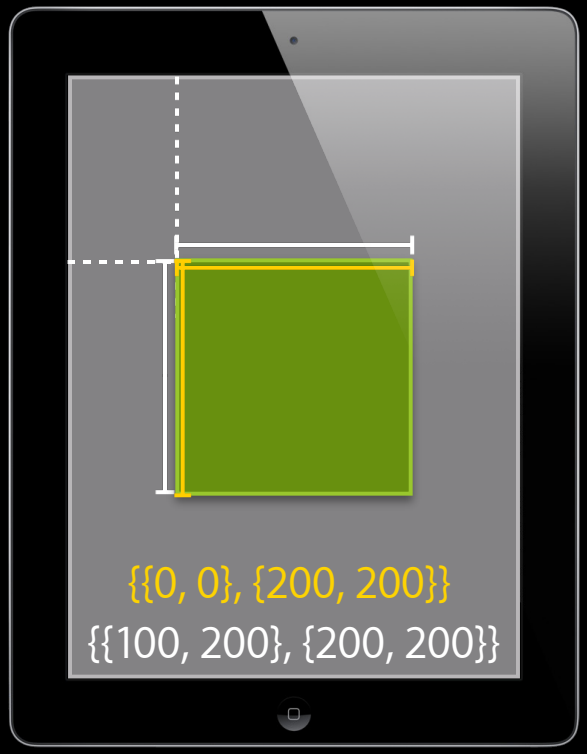
Center

Superview's Coordinate Space



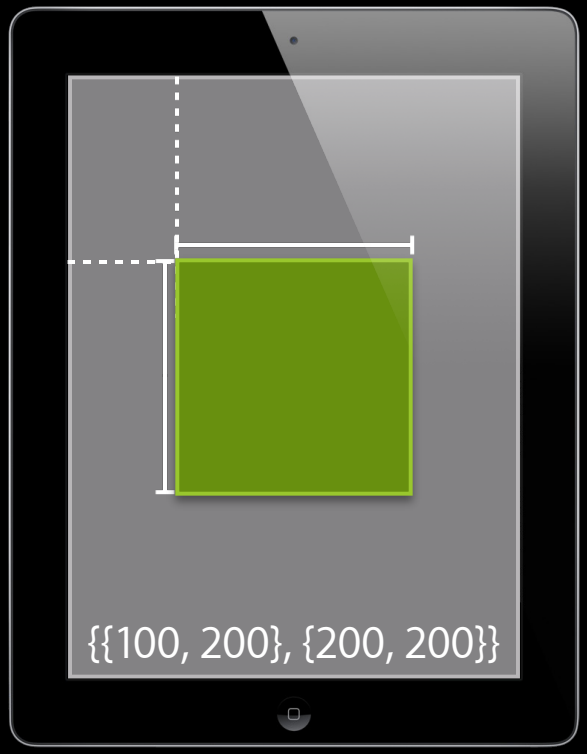
Bounds Size

View's Coordinate Space



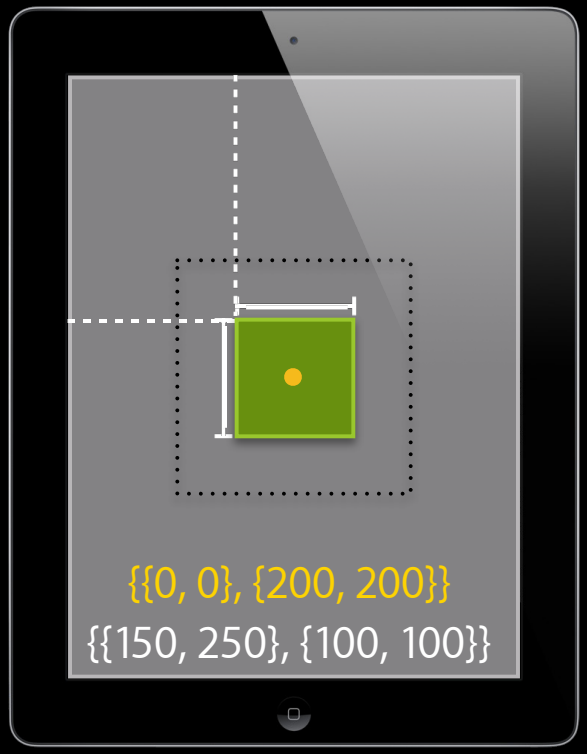
Transform

50% scale



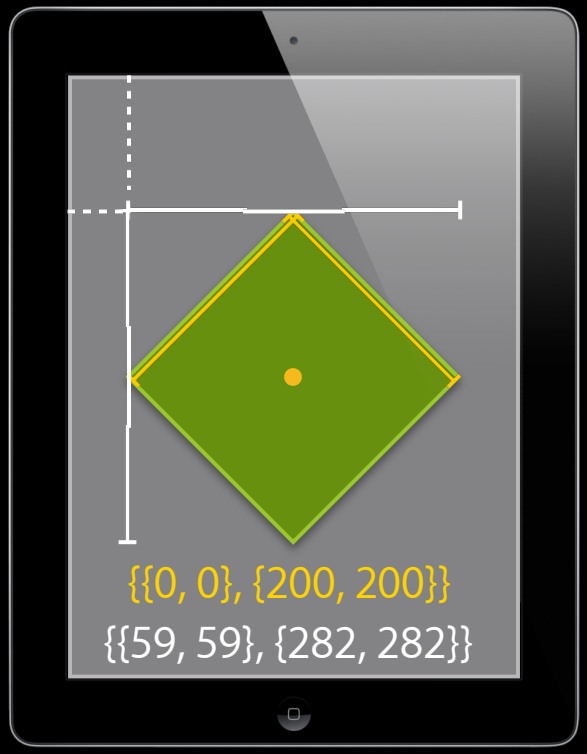
Transform

50% scale



Transform

45° rotation

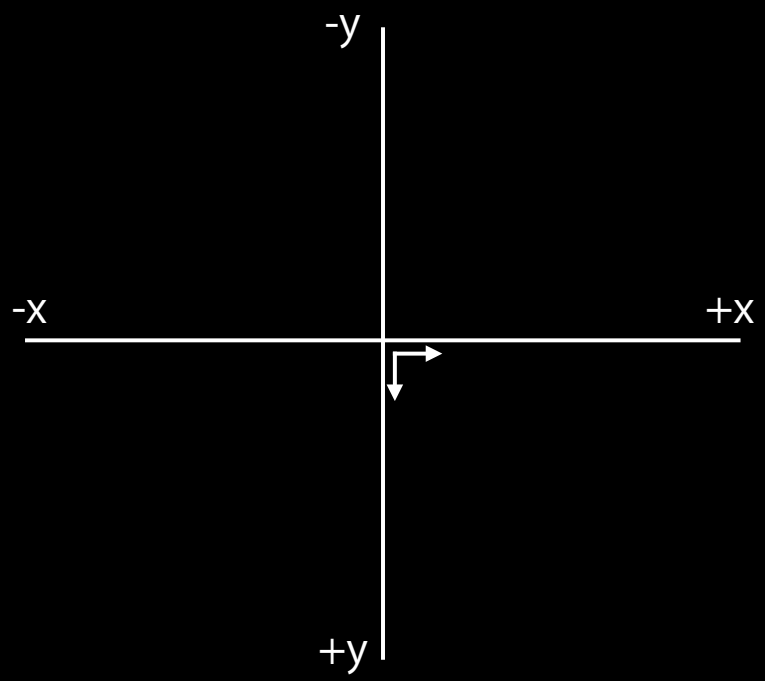


Components of Frame

UIView Property	CALayer Property	Coordinate Space
bounds.size	bounds.size	View
center	position	Superview
transform	affineTransform	Superview
	transform	Superlayer
	anchorPoint	Layer (Unit Coordinates)

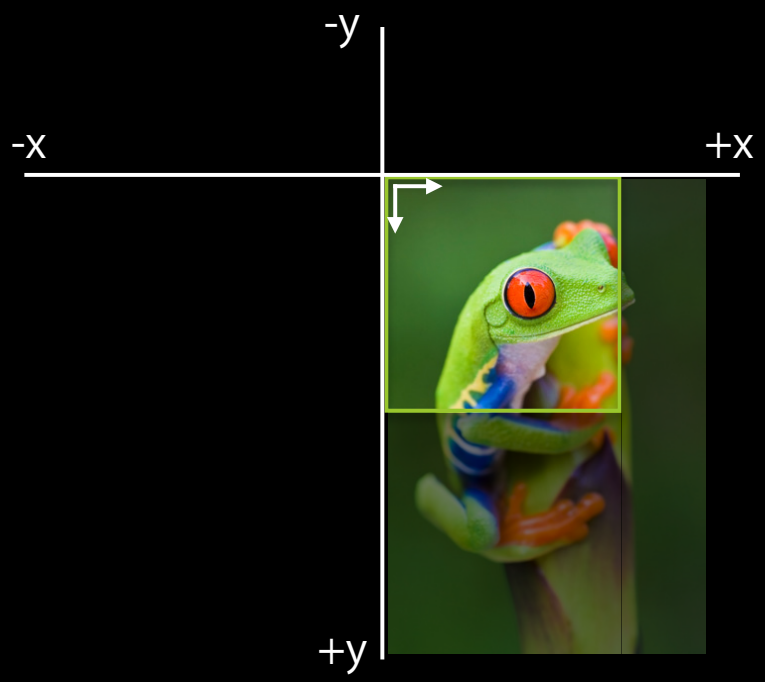
Bounds Origin

Window into a View



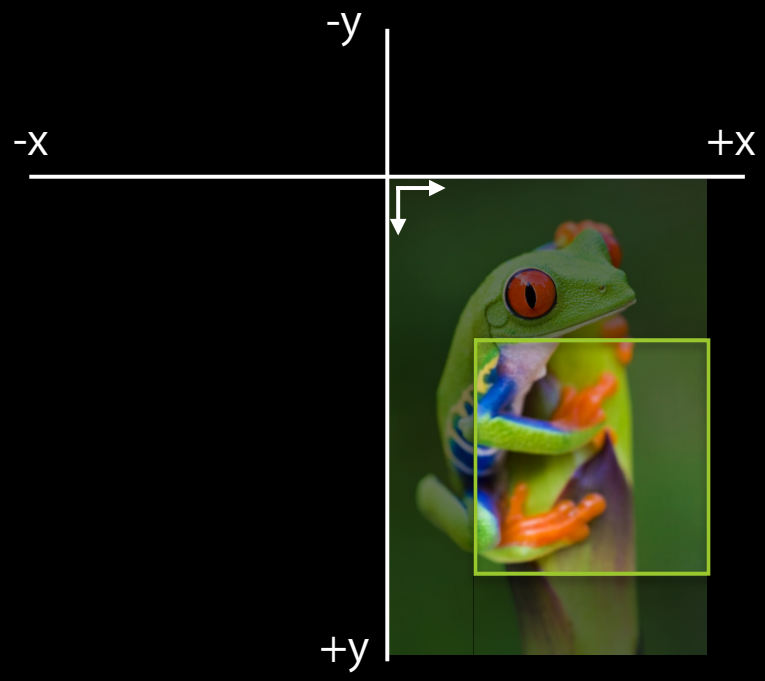
Bounds Origin

Window into a View



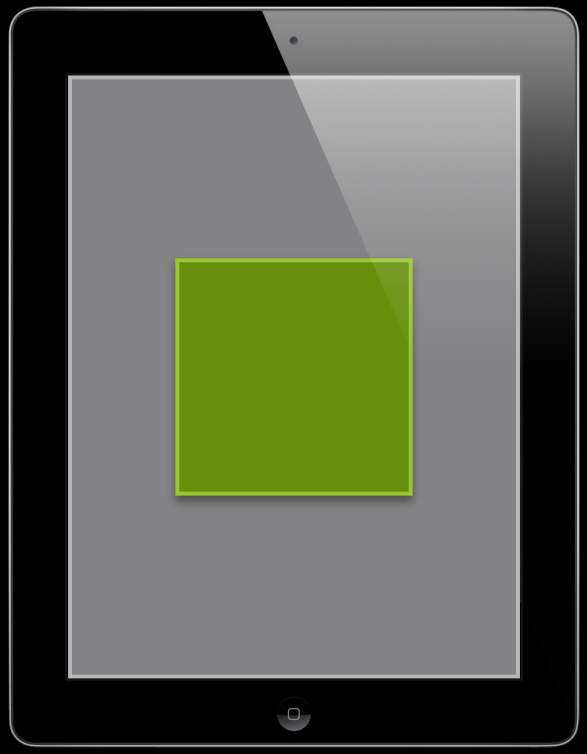
Bounds Origin

Window into a View



Bounds Origin

Window into a View



Bounds Origin

Window into a View

Bounds Origin

Window into a View

Bounds Origin

Window into a View

Drawing

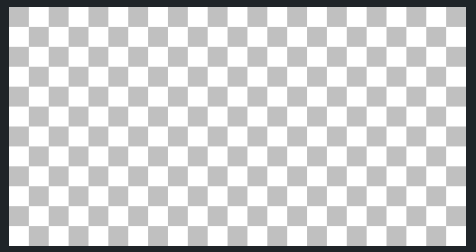
Where content comes from

- view.layer.contents
- UIImageView
- drawRect:

Practical Drawing for iOS Developers

Nob Hill
Thursday 4:30PM

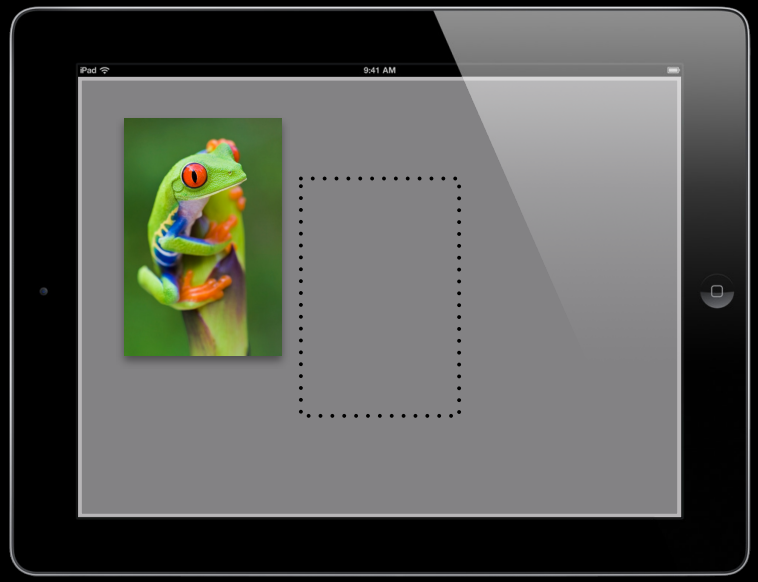
UIImageView vs. drawRect:

	drawRect:	UIImageView
Stretch to 320x200	250 additional kilobytes	0 additional bytes
Tile to 320x200	 250 additional kilobytes	Minimal additional memory for performance

CATransaction

When views get rendered

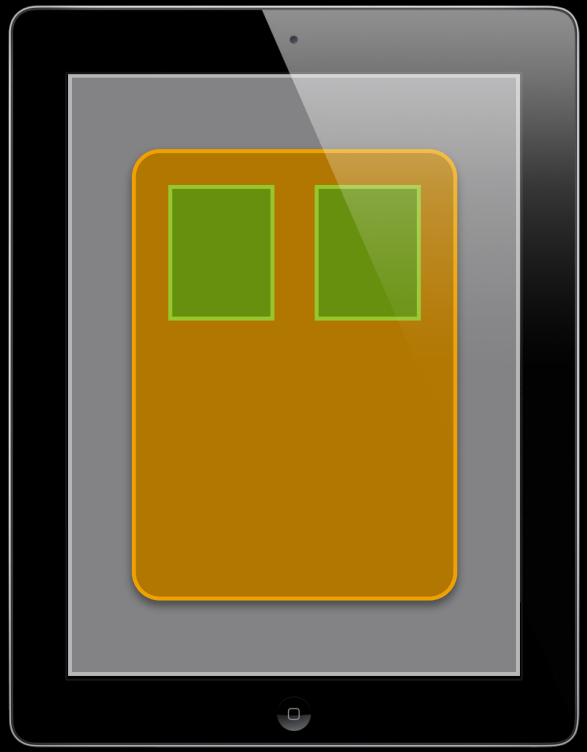
CATransaction	<implicit begin>		<implicit commit>
UIView	setFrame:	setTransform:	
Rendered			√



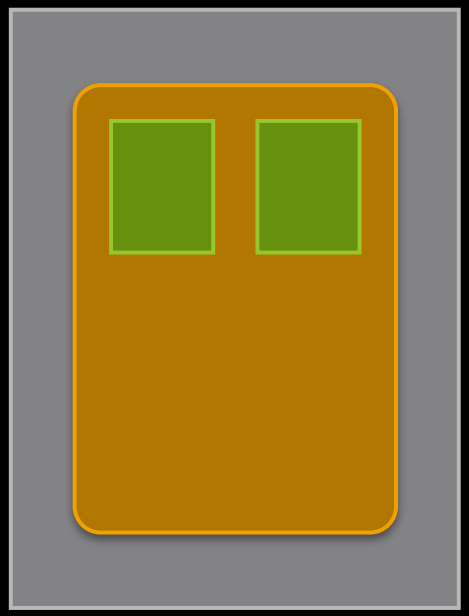
Performance

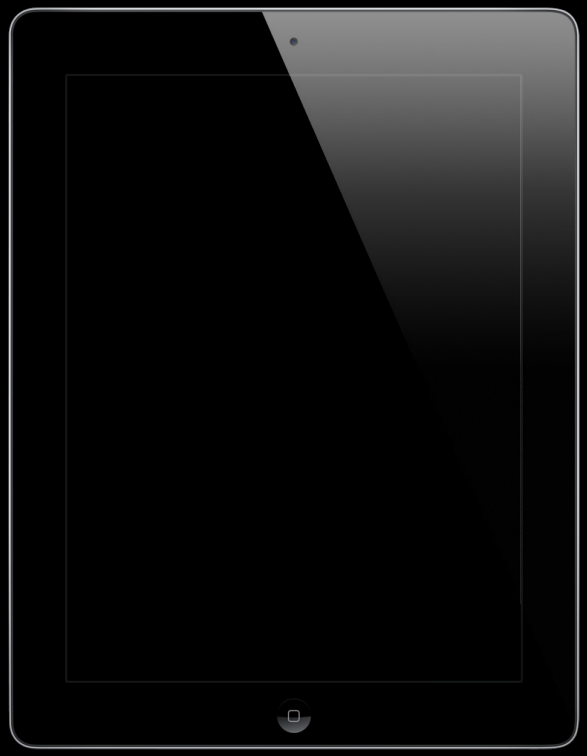
Looking good, fast

Avoid Offscreen Rendering

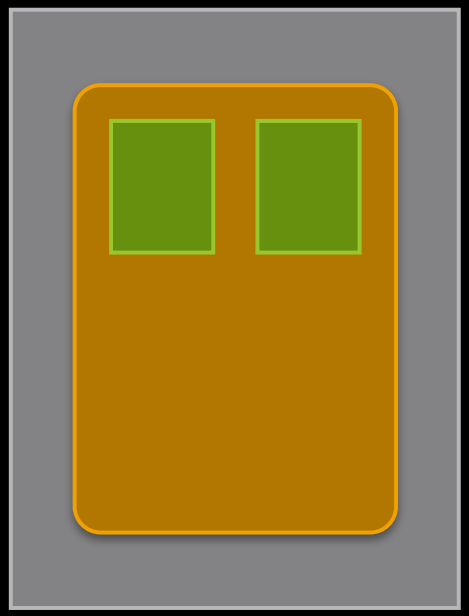


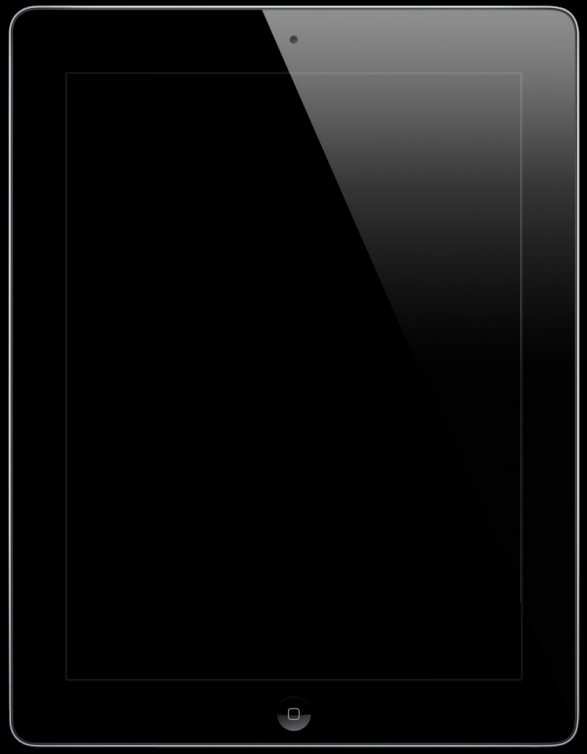
Rendering a Frame

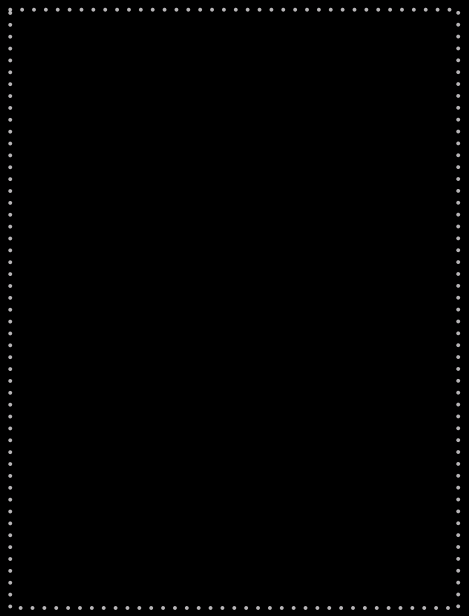




Rendering a Frame





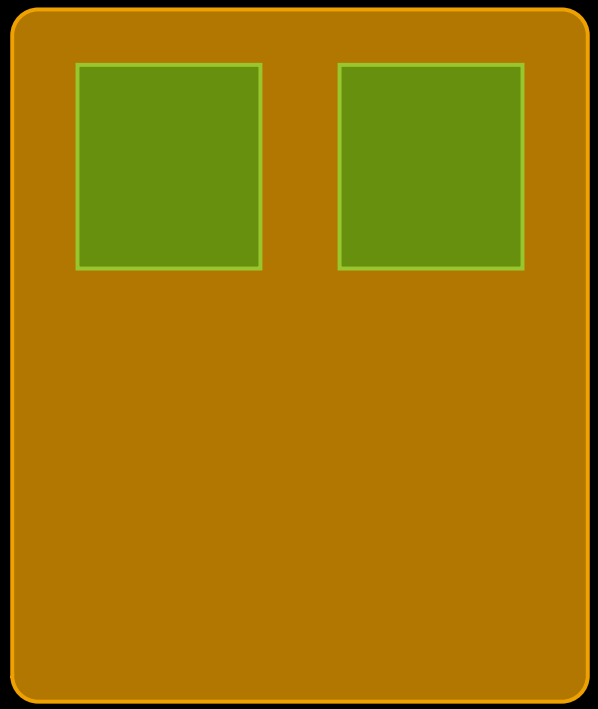


Layer Rasterization

Layer Rasterization

When your content doesn't change

- - [CALayer setShouldRasterize:]



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CuriousFrog

Clipping and Masking

Clipping and Masking

masksToBounds

- - [CALayer cornerRadius]
- - [CALayer mask]
- - [UIView clipsToBounds]
  - - [CALayer masksToBounds]

Clipping and Masking

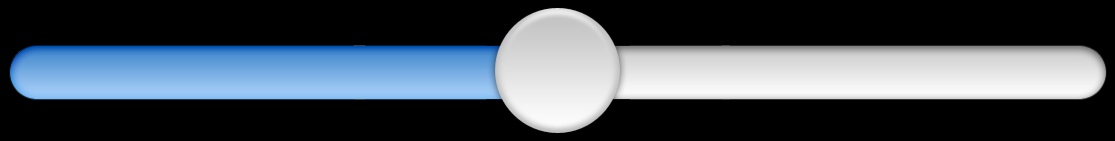
Tricks to fake it

- - [CALayer contentsRect]
- - [UIView drawRect:]
- Transparent overlay

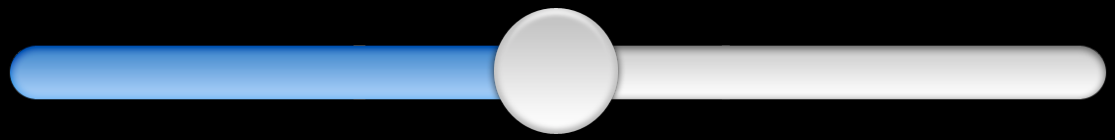
Group Opacity

Group Opacity

Setting alpha on a superview



With Group Opacity



Without Group Opacity

Group Opacity

Getting accurate rendered output

- UIViewGroupOpacity key in Info.plist
- Pre-render in drawRect:
- Set shouldRasterize = YES

Shadows

Shadowed text

Demo

Mathieu Martin
iOS Frameworks Engineer

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Shadows

Shadows

CoreAnimation layer shadows

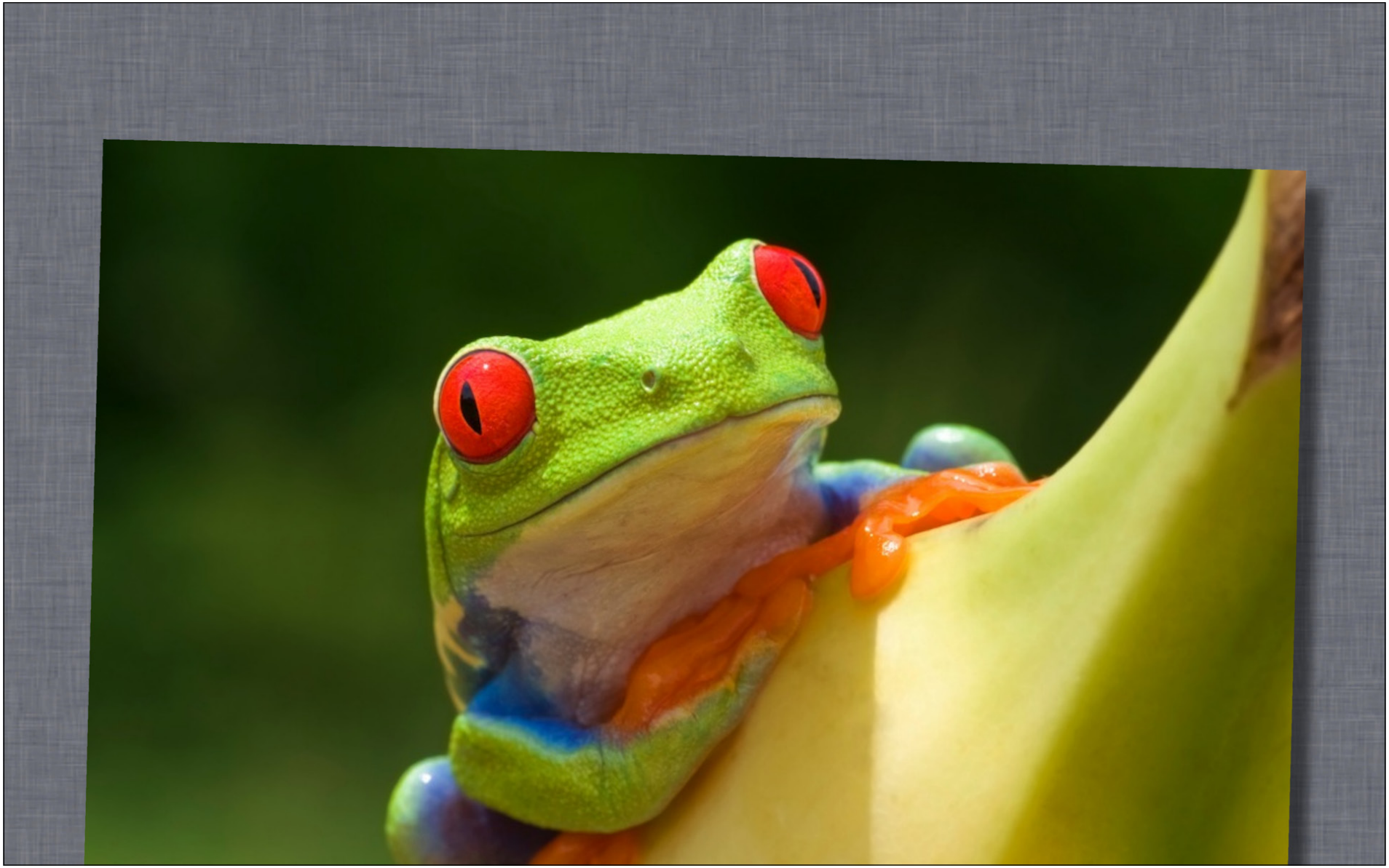
- - [CALayer shadowOffset]
- - [CALayer shadowColor]

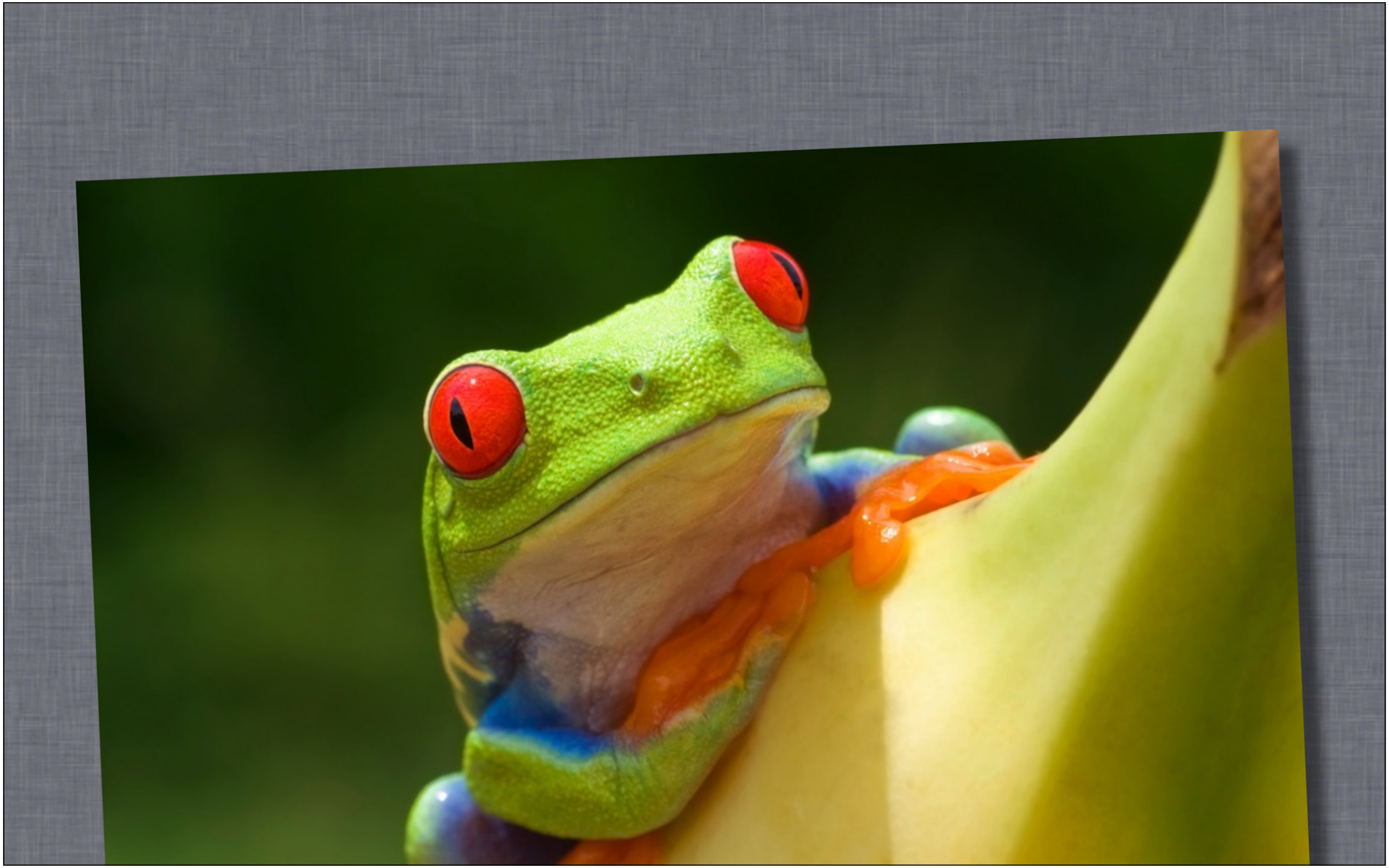
Shadows

Performance tweaks

- - [CALayer shadowPath]
- - [CALayer shouldRasterize]
- CoreGraphics shadows

Edge Anti-Aliasing



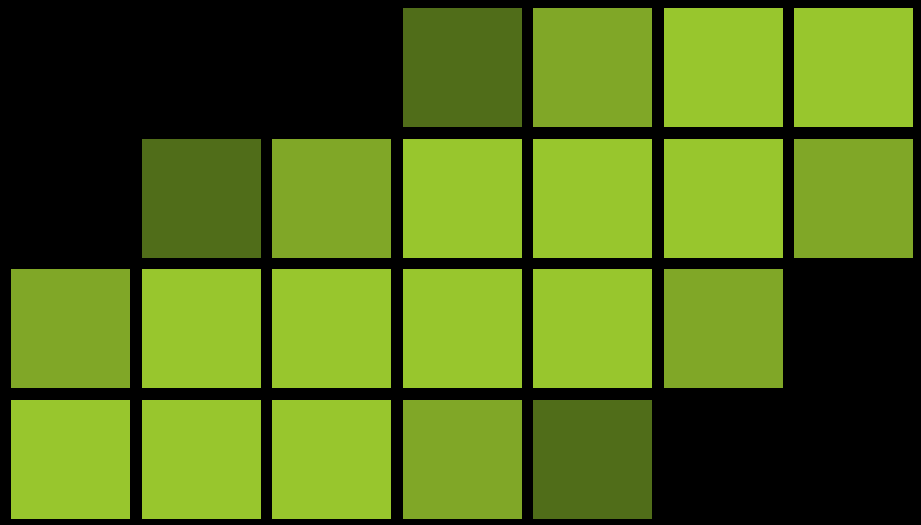


Edge Antialiasing

Smoothing the sides

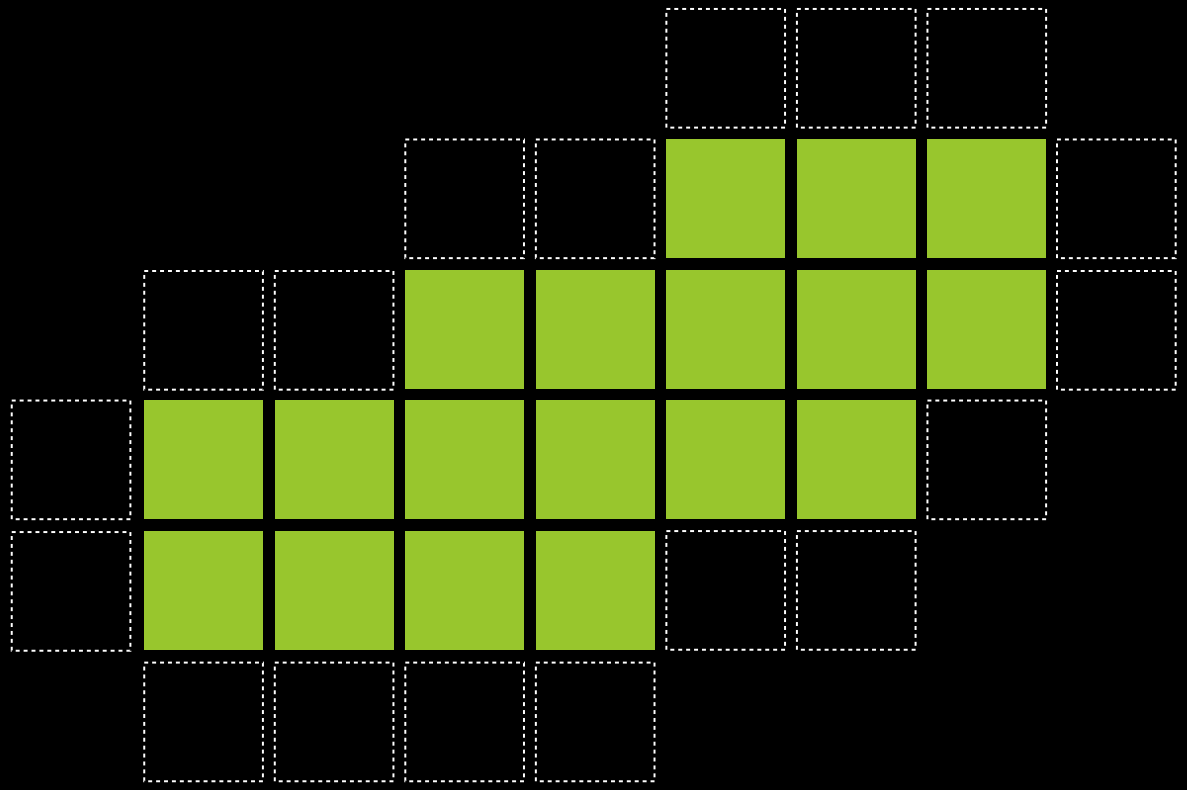
- UIViewEdgeAntialiasing key in Info.plist
- Fake it with a pixel border

Edge Antialiasing

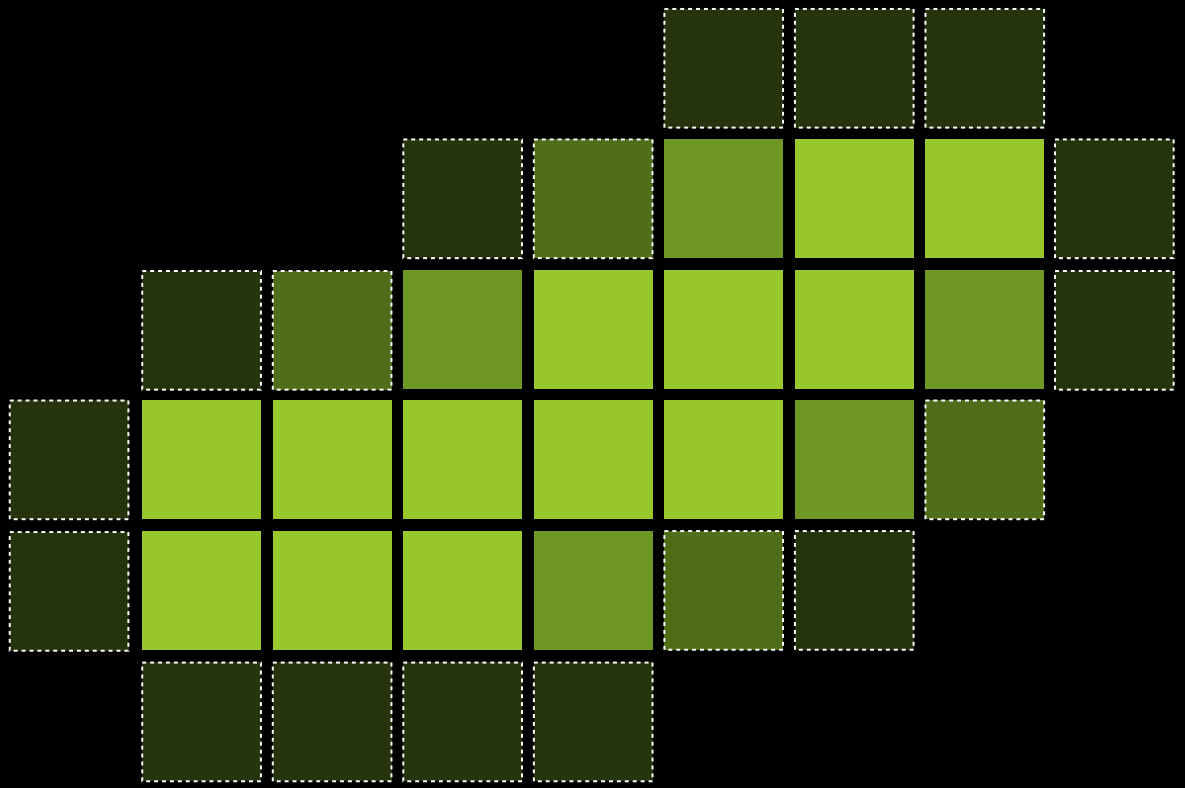


Edge Antialiasing

Edge Antialiasing



Edge Antialiasing



Demo

Andy Matuschak
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More Information

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aschaffer@apple.com

Documentation
View Programming Guide
http://developer.apple.com/library/mac/#documentation/cocoa/conceptual/CocoaViewsGuide/Introduction/Introduction.html

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

Related Sessions

Core Animation Essentials	Mission Thursday 11:30AM
Practical Drawing for iOS Developers	Nob Hill Thursday 4:30PM

Labs

Core Animation Lab	Graphics, Media & Games Lab C Thursday 2:00PM
Core Graphics Lab	Graphics, Media & Games Lab D Thursday 2:00PM

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