Mysteries of Auto Layout, Part 1

Session 218

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Kasia Wawer iOS Keyboards Engineer

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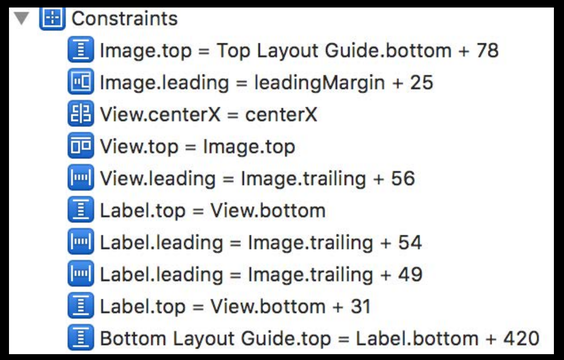
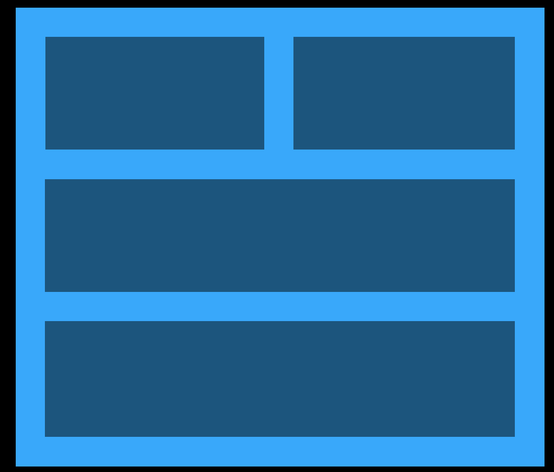
Auto Layout

Auto Layout


Constraints
Image.top = Top Layout Guide.bottom + 78
Image.leading = leadingMargin + 25
View.centerX = centerX
View.top = Image.top
View.leading = Image.trailing + 56
Label.top = View.bottom
Label.leading = Image.trailing + 54
Label.leading = Image.trailing + 49
Label.top = View.bottom + 31
Bottom Layout Guide.top = Label.bottom + 420



Getting Started with Auto Layout?

See previous WWDC sessions on

http://developer.apple.com/videos/

Outline

Part 1 — Morning

- Maintainable Layouts
- Changing Constraints
- View Sizing
- Self-Sizing Table View Cells
- Priorities
- Alignment

Part 2 — Afternoon

- The Layout Cycle
- Legacy Layout
- Constraint Creation
- Constraining Negative Space
- Unsatisfiable Constraints
- Resolving Ambiguity

Outline

Part 1 — Morning

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Maintainable Layouts

Mystery #1

Constraints

Spacing and alignment

Mysteries of Auto Layout

Constraints

Spacing and alignment

Mysteries of Auto Layout

Mysteries of Auto Layout

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Essentials

★★★★☆ (1,085)

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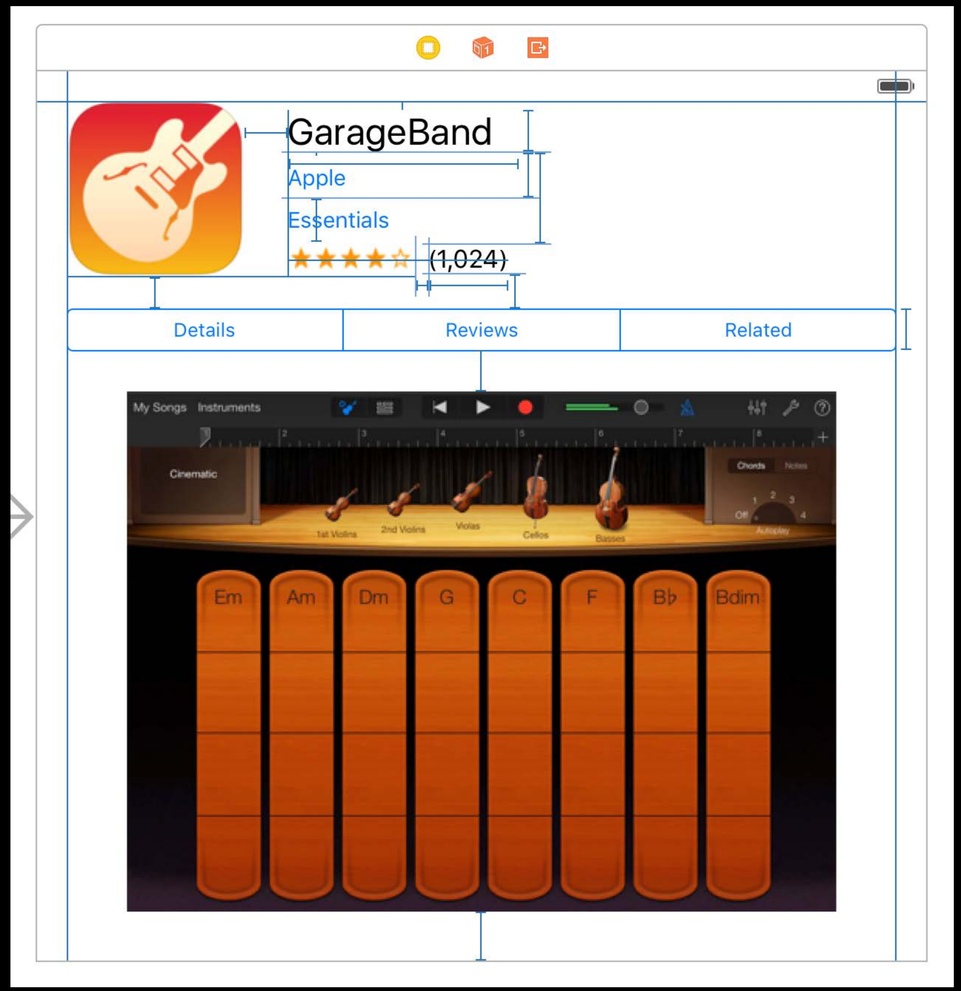
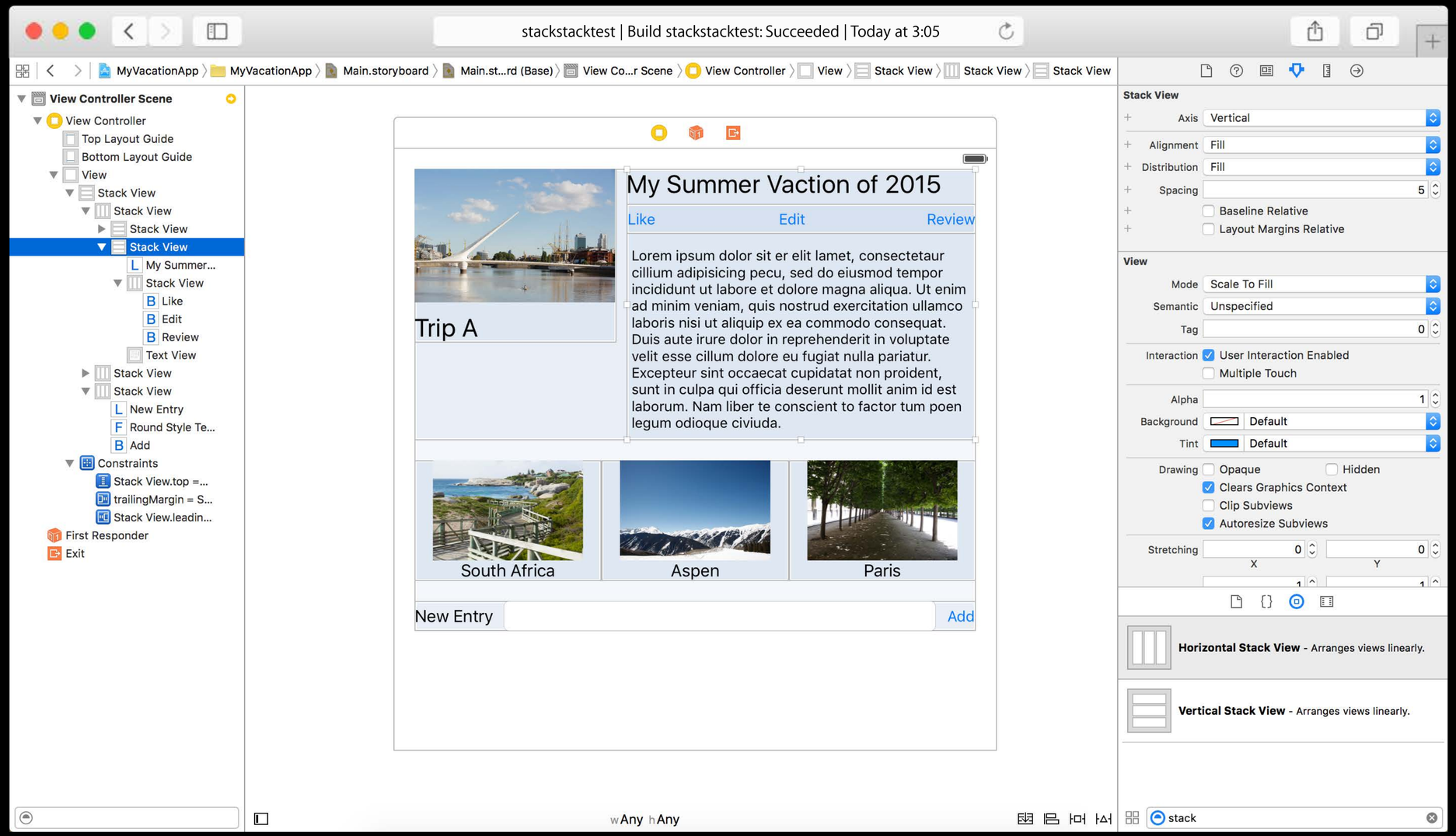
Many Constraints



Stack View

UIStackView (iOS 9) and NSStackView (OS X 10.9)

NEW



Stack View

NEW

Stack View

NEW

Built with Auto Layout

Stack View

NEW

Built with Auto Layout

Manages constraints

Stack View

NEW

Built with Auto Layout

Manages constraints

Horizontal or vertical

Stack View

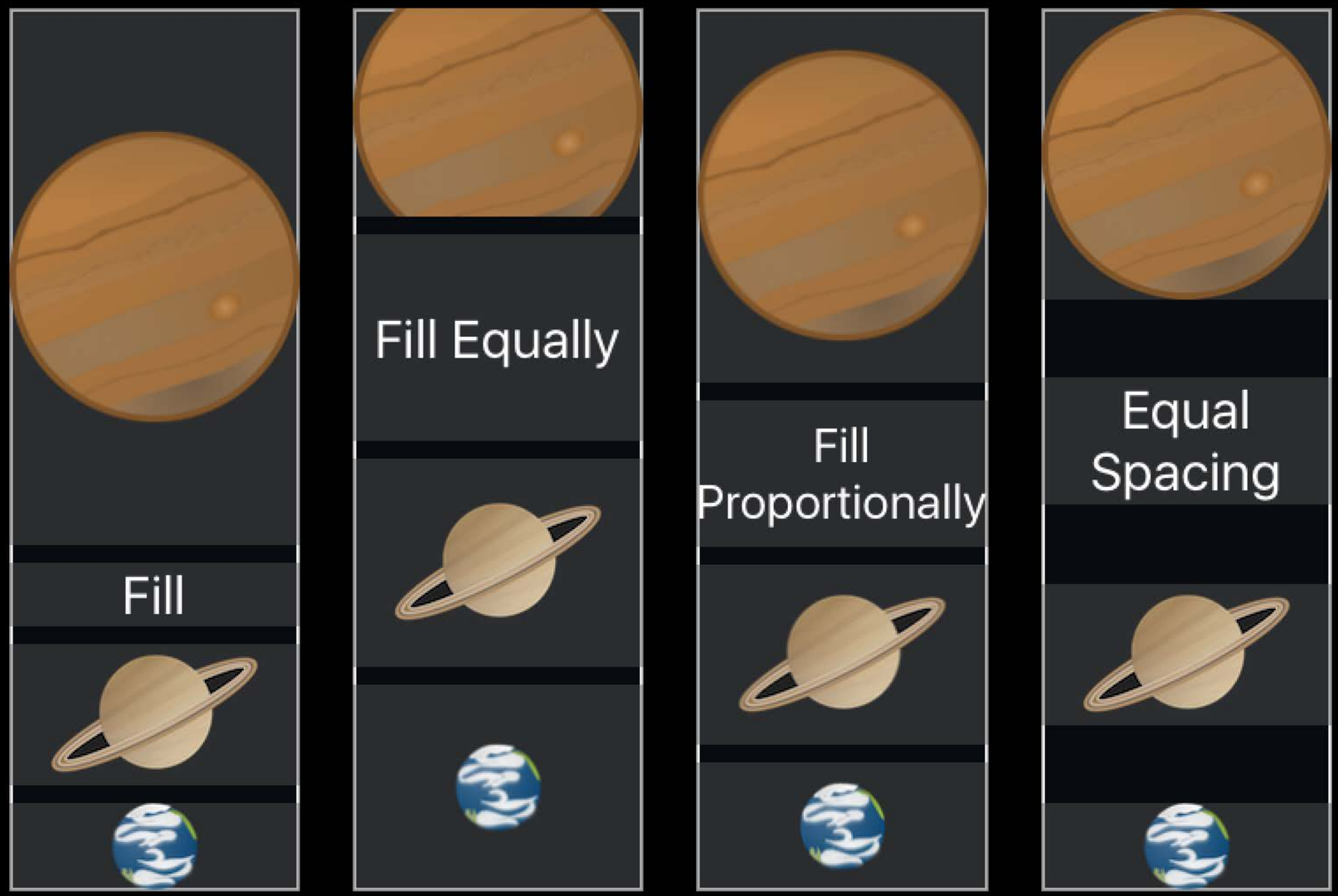
Alignment

Stack View

Alignment

Stack View

Distribution



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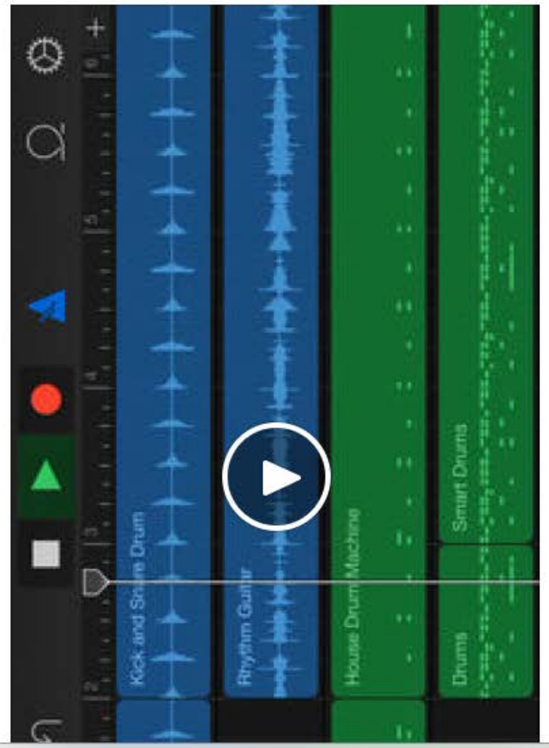

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Demo

Stack View in Interface Builder

Animate

```
// iOS 9
UIView.animateWithDuration(1.0) { () -> Void in
     self.subviewToHide.hidden = !self.subviewToHide.hidden
}
```

Animate

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// iOS 9
UIView.animateWithDuration(1.0) { () -> Void in
     self.subviewToHide.hidden = !self.subviewToHide.hidden
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Animate

```
// iOS 9
UIView.animateWithDuration(1.0) {
     self.subviewToHide.hidden = !self.subviewToHide.hidden
}
```

```
// OS X 10.11
NSAnimationContext.runAnimationGroup({ context in
    context.duration = 1.0
    self.subviewToHide.animator().hidden = !self.subviewToHide.hidden
}, completionHandler: nil)
```

API

```
// iOS 9
class UIStackView  {
var axis:UILayoutConstraintAxis
var distribution:UIStackViewDistribution
var alignment:UIStackViewAlignment
var spacing:CGFloat
func addArrangedSubview(view: UIView)
var arrangedSubviews:[UIView]
…
}
```

```
// OS X 10.11
class NSStackView  {
var orientation:NSUserInterfaceOrientation
var distribution:NSStackViewDistribution
var alignment:NSLayoutAttribute
var spacing:CGFloat
func addArrangedSubview(view: NSView)
var arrangedSubviews:[NSView]
…
}
```

API

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Stack View in Interface Builder

Stack View in Interface Builder

Easy to build

Stack View in Interface Builder

Easy to build

Easy to maintain

Stack View in Interface Builder

Easy to build

Easy to maintain

Composable Stack Views

Stack View in Interface Builder

Easy to build

Easy to maintain

Composable Stack Views

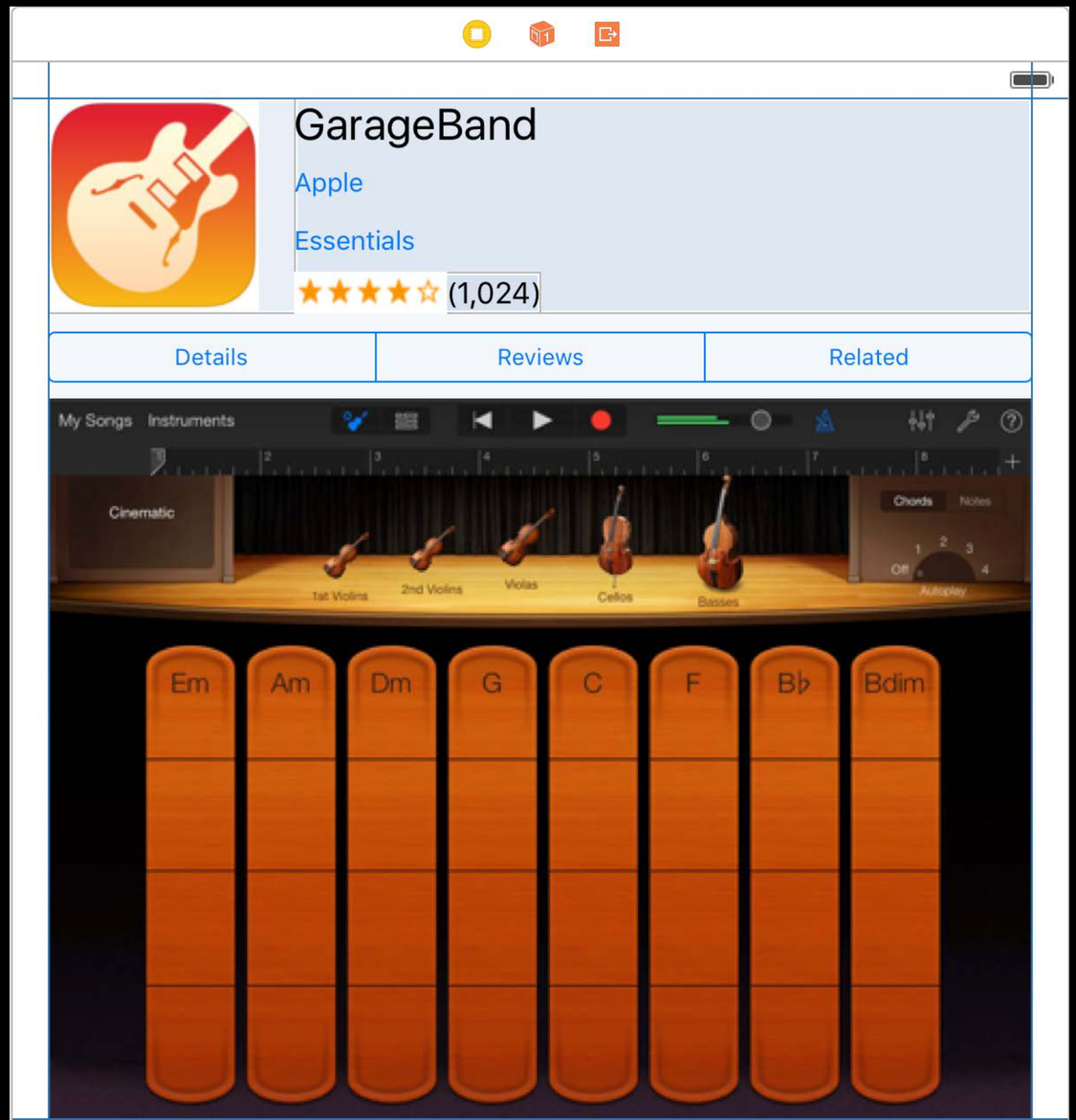
Lightweight

Before and After

Before, many constraints

Before and After

After, four constraints with Stack View



Start with Stack View,
use constraints as needed

Feeding the Layout Engine

Mysteries of Auto Layout, part 1

Kasia Wawer iOS Keyboards Engineer

Getting from Constraints to Layout

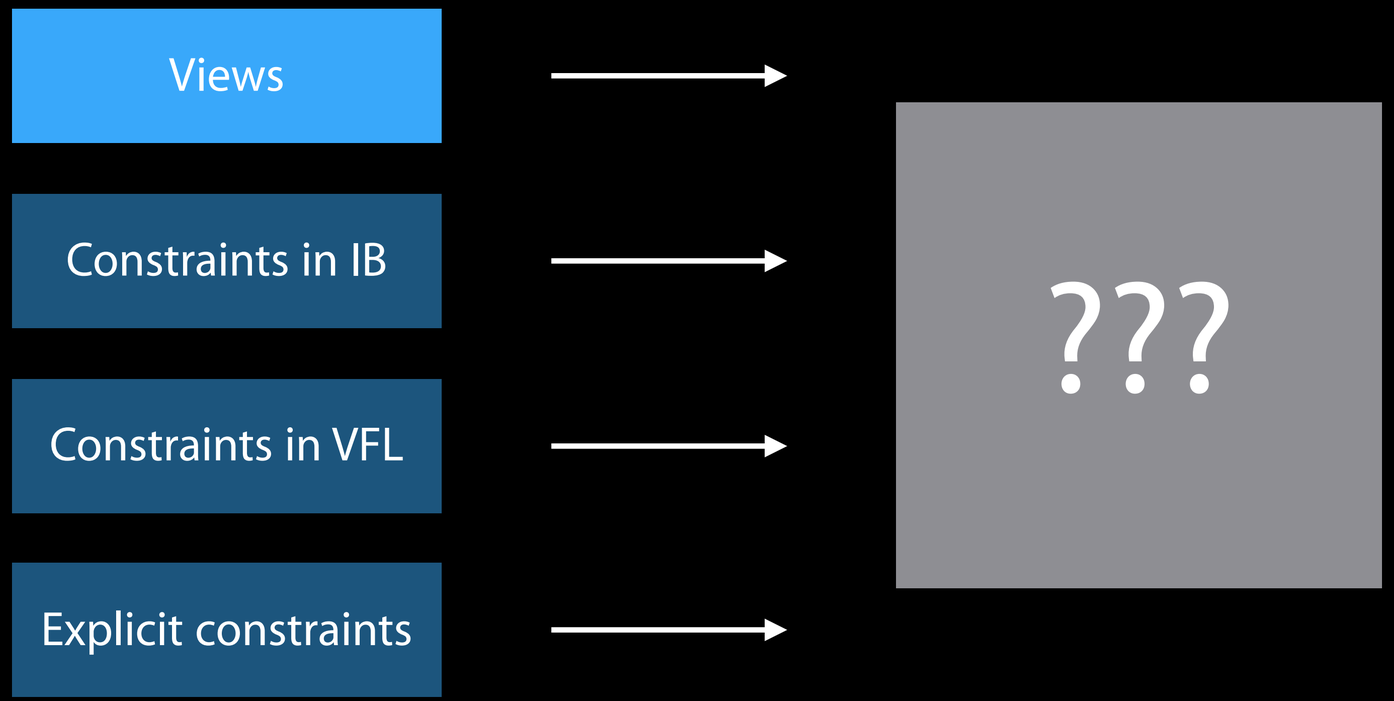
Views

Constraints in IB

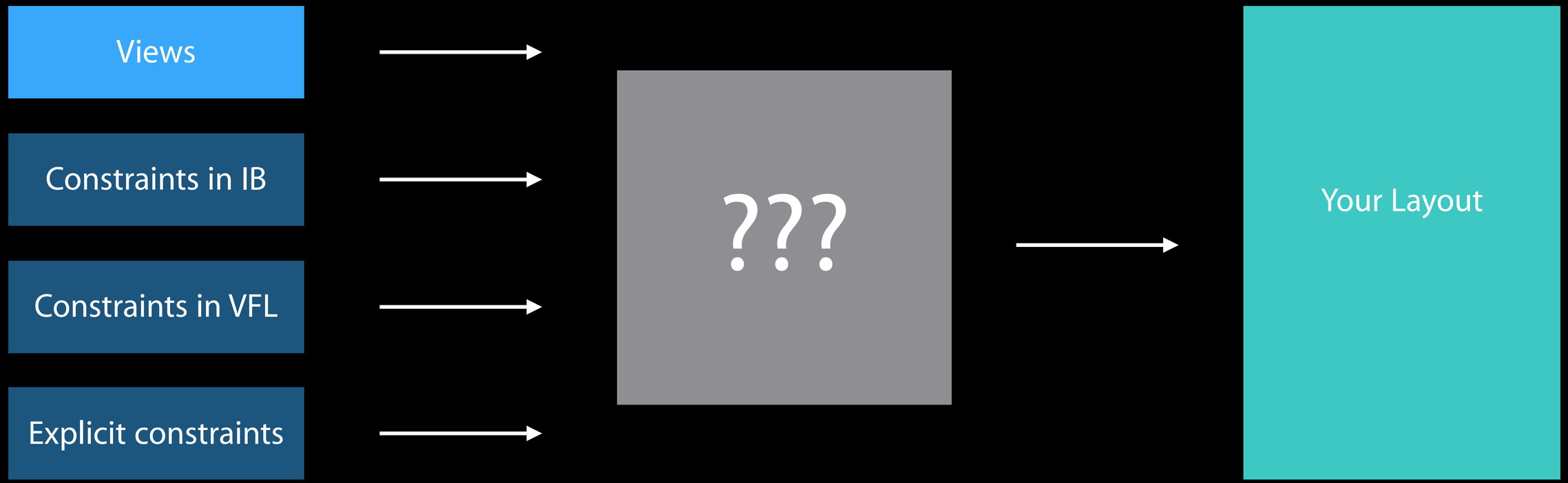
Constraints in VFL

Explicit constraints

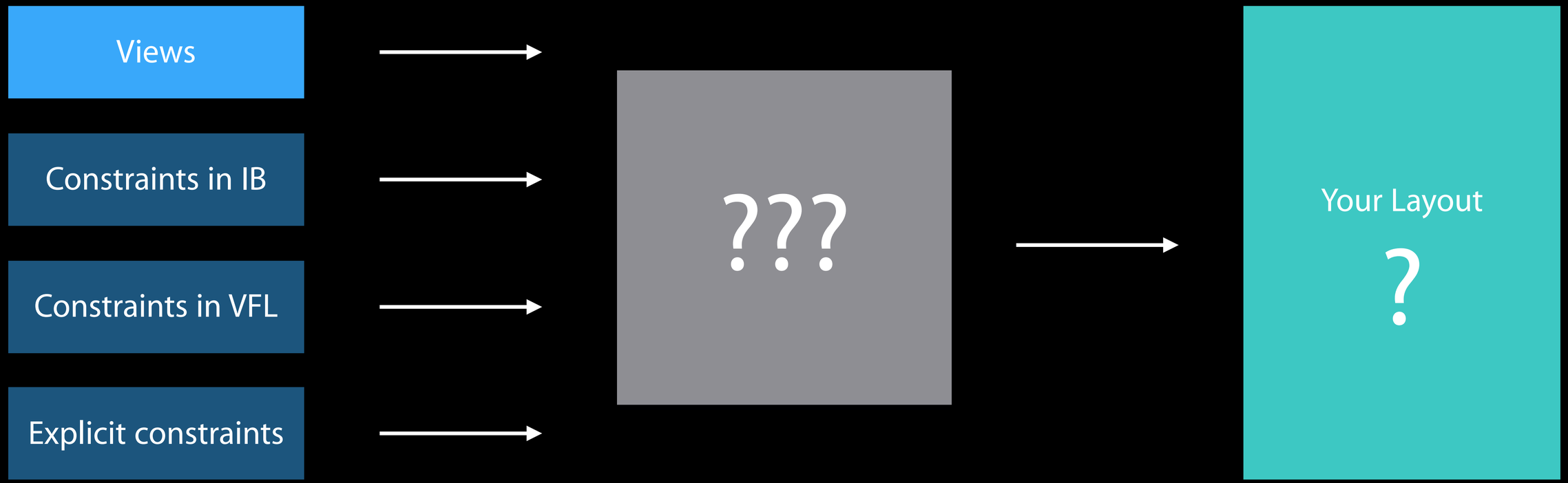
Getting from Constraints to Layout



Getting from Constraints to Layout



Getting from Constraints to Layout



Getting from Constraints to Layout

Getting from Constraints to Layout

Changing Constraints

Mystery #2

Activate and Deactivate

Activate and Deactivate

Constraints find their own container

Activate and Deactivate

Constraints find their own container

Adds constraints efficiently

Activate and Deactivate

Constraints find their own container

Adds constraints efficiently

Do not need to own all views

Activate and Deactivate

Activate and Deactivate

Add and remove

Activate and Deactivate

Activate and deactivate

Things to Keep in Mind

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Never deactivate `self.view.constraints`

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Never deactivate `self.view.constraints`

- Not all of those constraints belong to you

Things to Keep in Mind

Never deactivate `self.view.constraints`

- Not all of those constraints belong to you
- Weird things will happen

Things to Keep in Mind

Never deactivate `self.view.constraints`

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- Just don’t do it!

Things to Keep in Mind

Never deactivate `self.view.constraints`

- Not all of those constraints belong to you
- Weird things will happen
- Just don’t do it!

Keep references to constraints that change

Demo

Changing constraints

Changing Constraints

Changing Constraints

Never deactivate `self.view.constraints`

Changing Constraints

Never deactivate `self.view.constraints`

Keep references to constraints

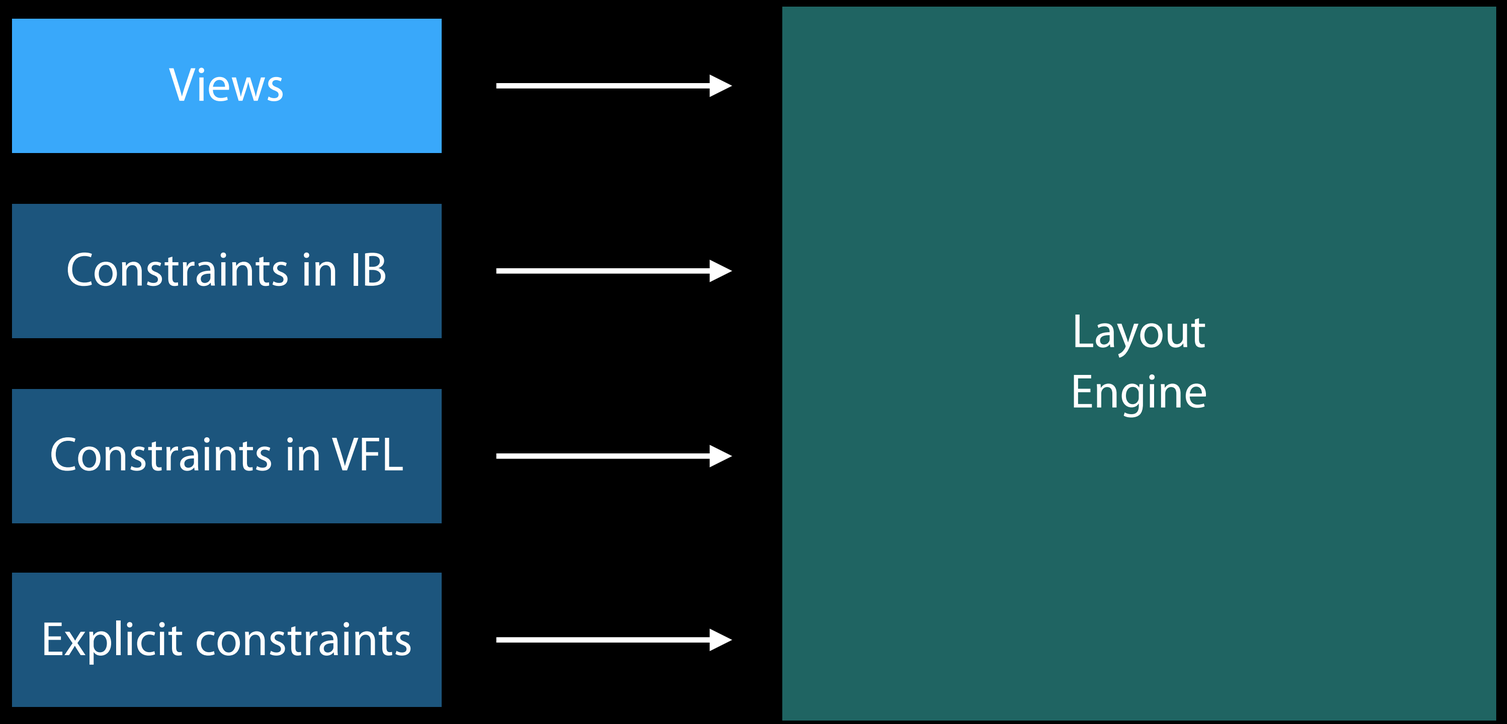
Changing Constraints

Never deactivate `self.view.constraints`

Keep references to constraints

Animate changing constraints with view animation

Building the Layout

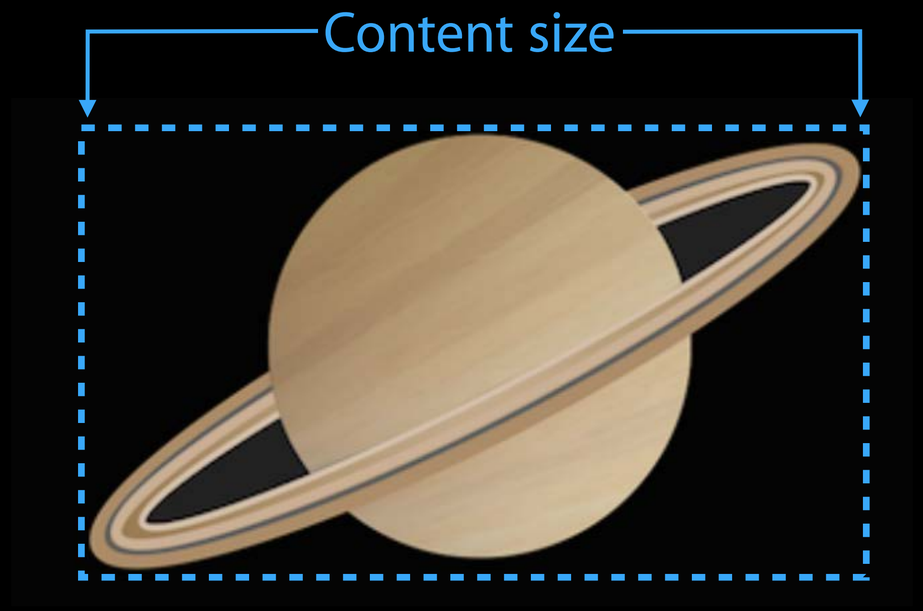


View Sizing

Mystery #3

View Size

Intrinsic content size

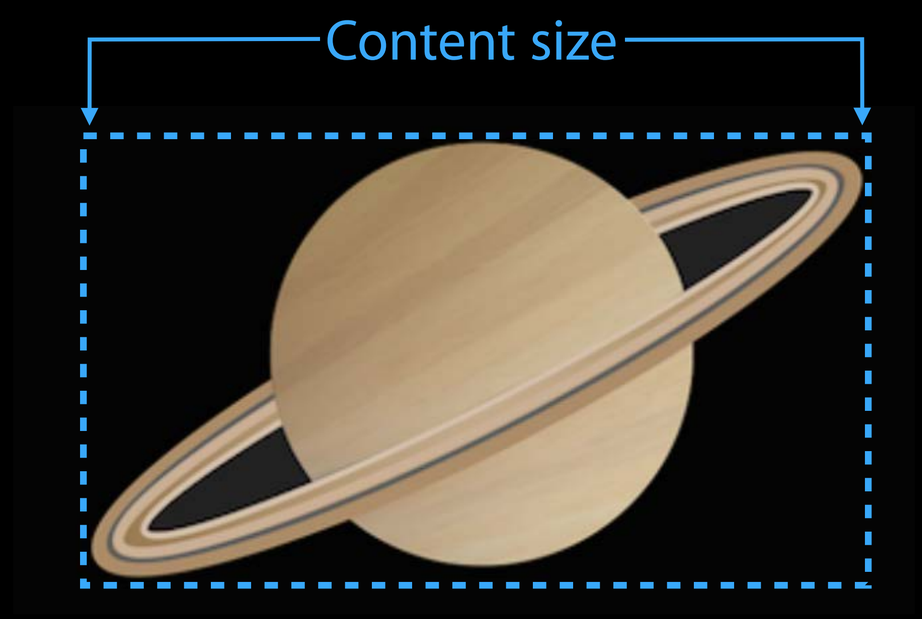


View Size

Intrinsic content size

Certain views have an `intrinsicContentSize`

- For instance–labels and image views



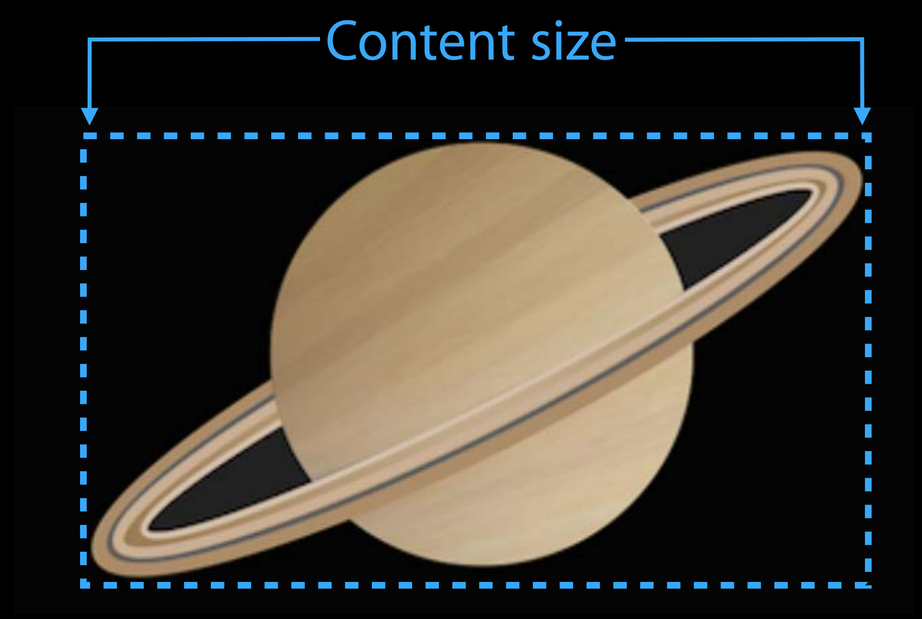
View Size

Intrinsic content size

Certain views have an `intrinsicContentSize`

- For instance–labels and image views

Size derived from non-constraint internals



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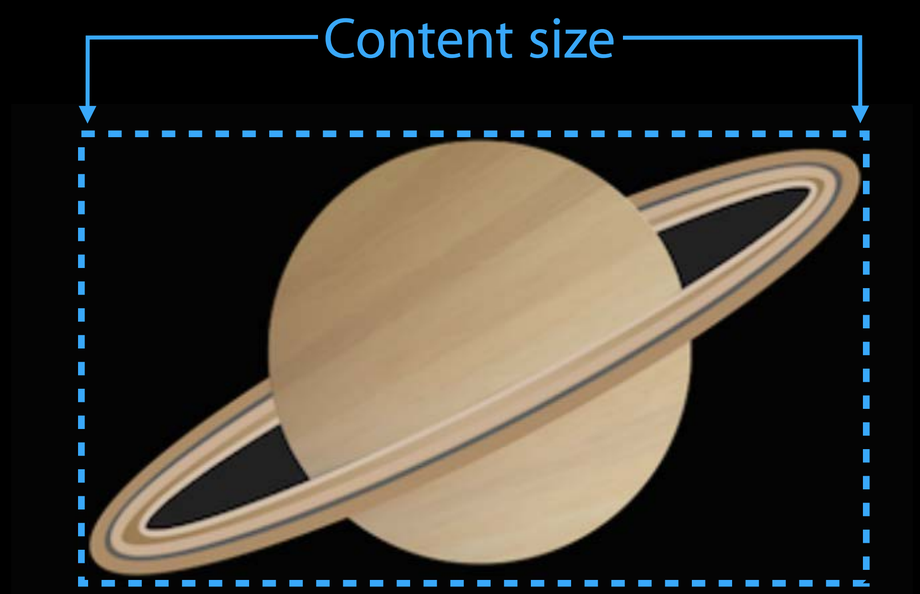
Size derived from non-constraint internals

System makes the size constraints



View Size

Intrinsic content size

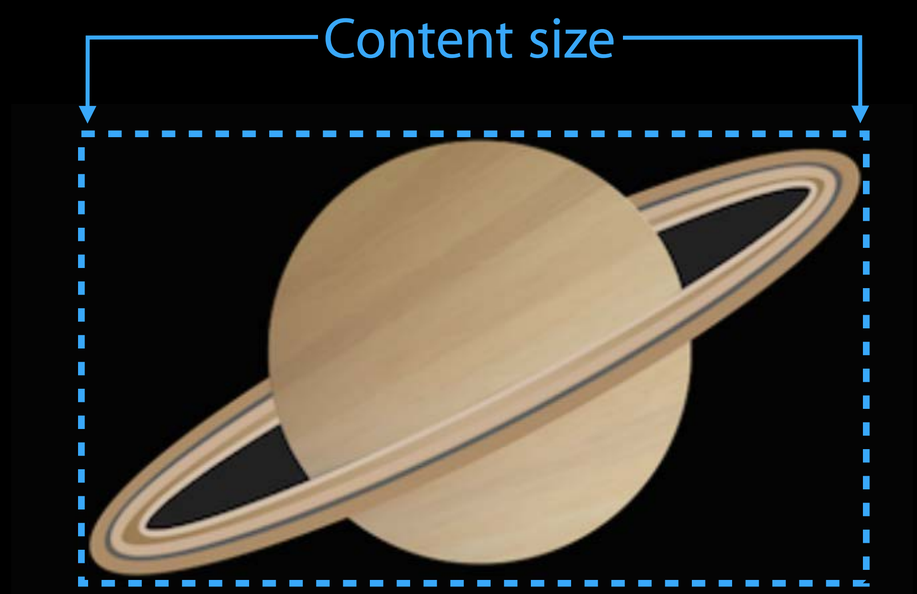
Certain views have an `intrinsicContentSize`

- For instance–labels and image views

Size derived from non-constraint internals

System makes the size constraints

Layout size is not guaranteed



View Size

Defining a particular view size

View Size

Defining a particular view size

Use constraints first

View Size

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Use constraints first

Override `intrinsicContentSize` for specific reasons

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- You will be responsible for invalidating

View Size

Defining a particular view size

Use constraints first

Override `intrinsicContentSize` for specific reasons

- If size information does not come from constraints
- If view has custom drawing (sometimes)
- You will be responsible for invalidating

Size can change with size class changes

Example

Example

```
widthConstraint =
NSLayoutConstraint(item: imageView,
 attribute: .Width,
 relatedBy: .Equal,
    toItem: self.view,
 attribute: .Width,
multiplier: 0.75, constant: 0.0)
```

Example

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widthConstraint =
NSLayoutConstraint(item: imageView,
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 relatedBy: .Equal,
    toItem: self.view,
 attribute: .Width,
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```
heightConstraint =
NSLayoutConstraint(item: imageView,
 attribute: .Height,
 relatedBy: .Equal,
    toItem: imageView,
 attribute: .Width,
multiplier: 1.5, constant: 0.0)
```

Example

```
widthConstraint =
NSLayoutConstraint(item: imageView,
 attribute: .Width,
 relatedBy: .Equal,
    toItem: self.view,
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heightConstraint =
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```
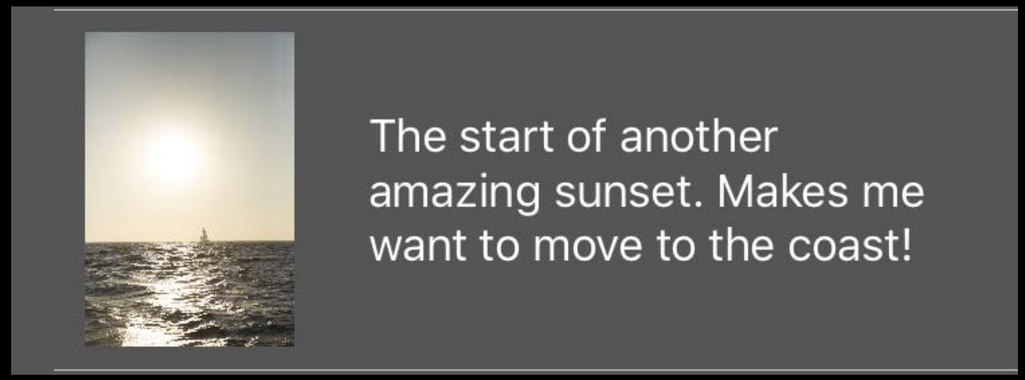

Self-Sizing Table View Cells

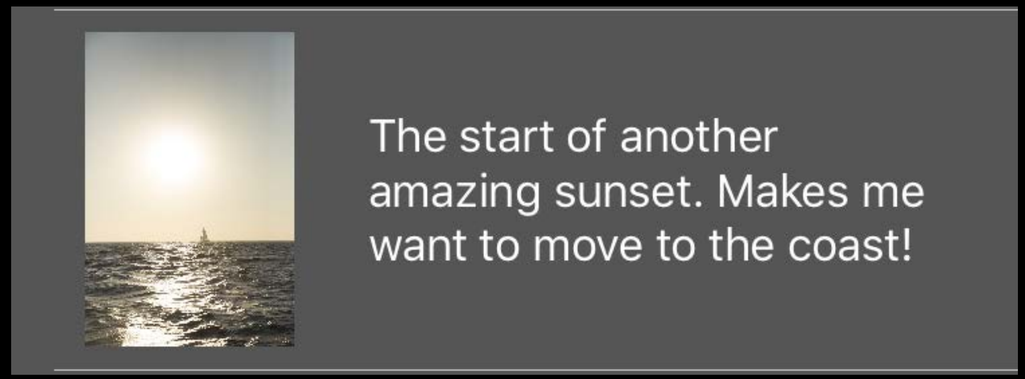
Mystery #4

Self-Sizing Table View Cells



Self-Sizing Table View Cells

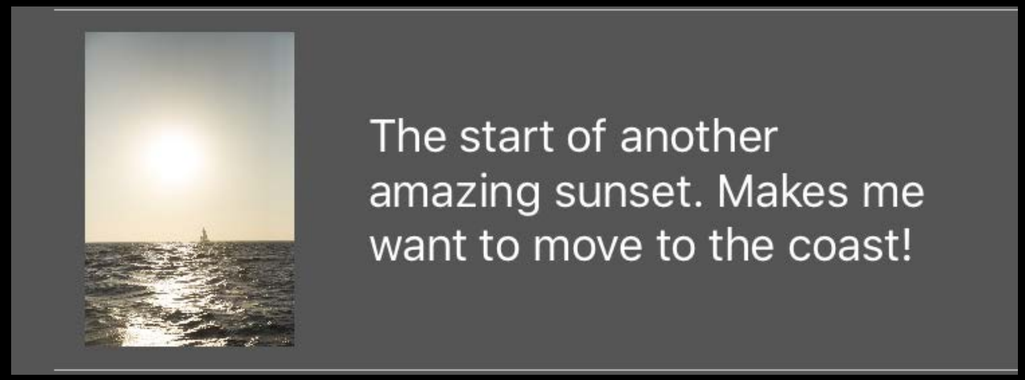
Self-sizing needs size from constraints



Self-Sizing Table View Cells

Self-sizing needs size from constraints

Width is defined with table view cells

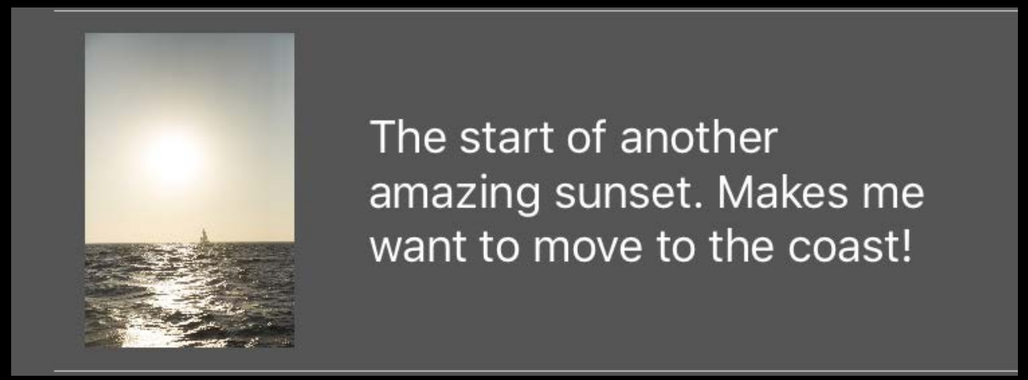


Self-Sizing Table View Cells

Self-sizing needs size from constraints

Width is defined with table view cells

Constraints must determine height



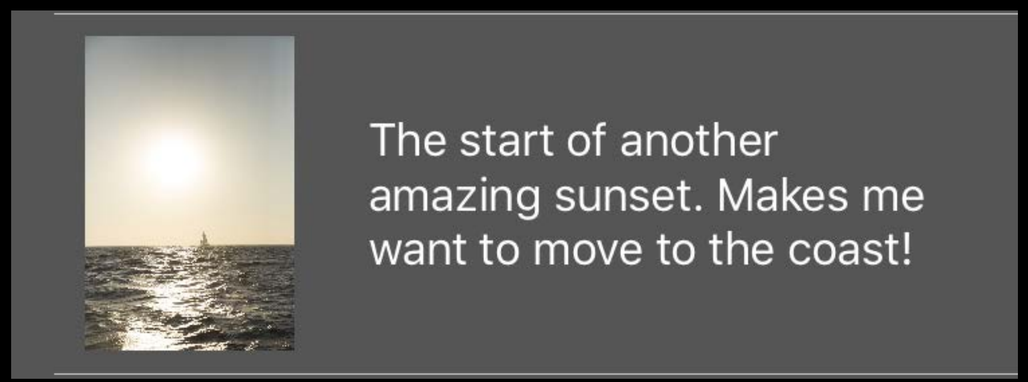
Self-Sizing Table View Cells

Self-sizing needs size from constraints

Width is defined with table view cells

Constraints must determine height

- Take advantage of proportions



Self-Sizing Table View Cells

Self-sizing needs size from constraints

Width is defined with table view cells

Constraints must determine height

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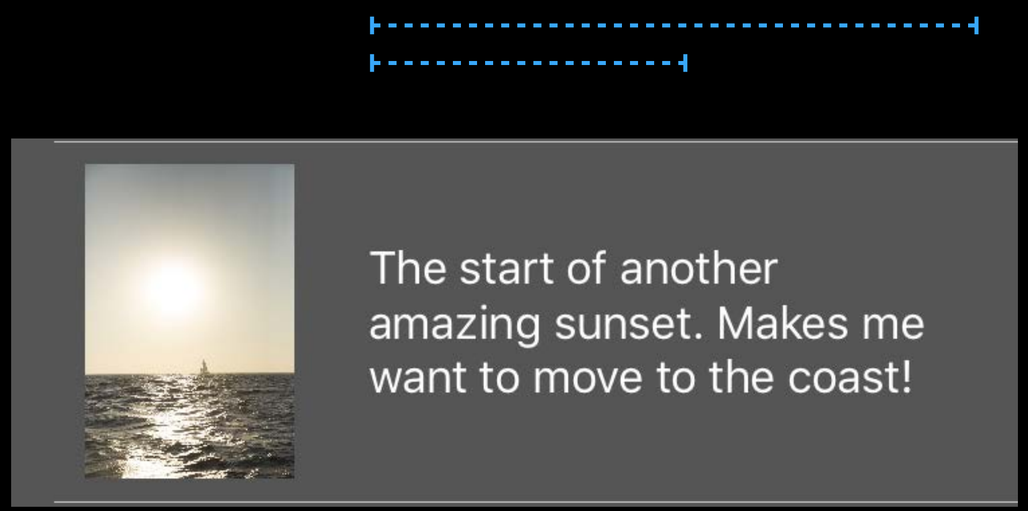

Self-Sizing Table View Cells

Self-sizing needs size from constraints

Width is defined with table view cells

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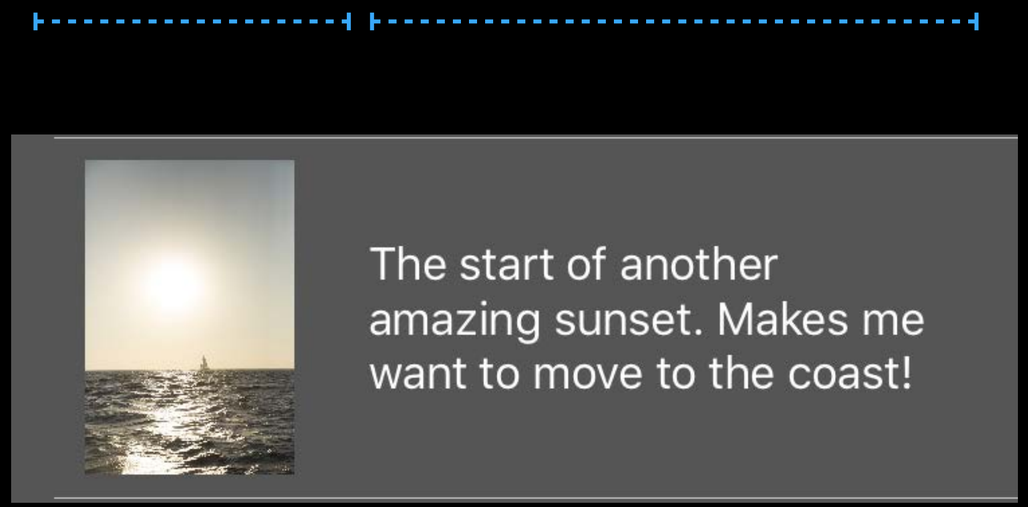

Self-Sizing Table View Cells

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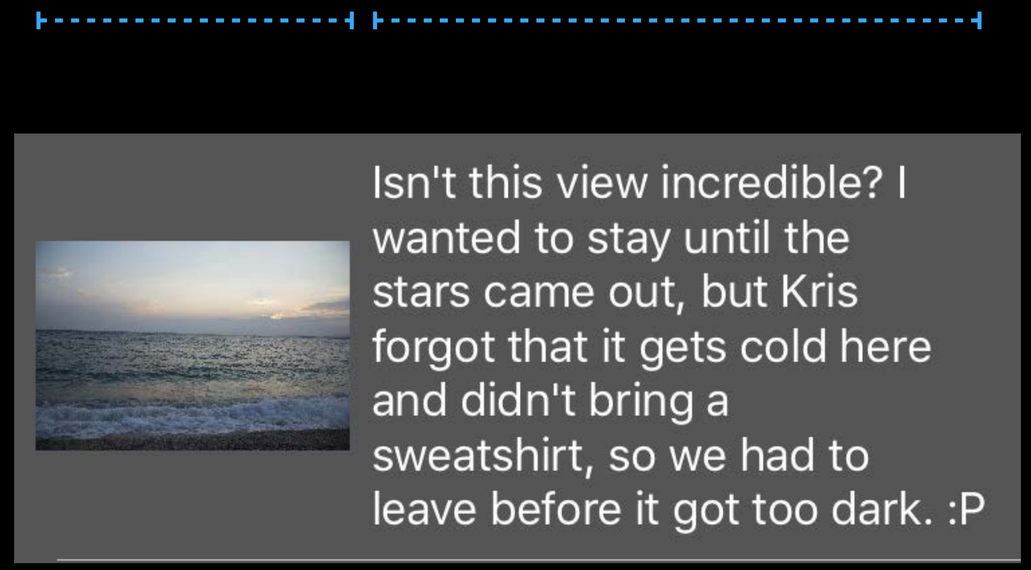


Demo

Self-sizing Table View Cells

View Sizing

View Sizing

Certain views have an `intrinsicContentSize`

View Sizing

Certain views have an `intrinsicContentSize`

Constraints should define size when possible

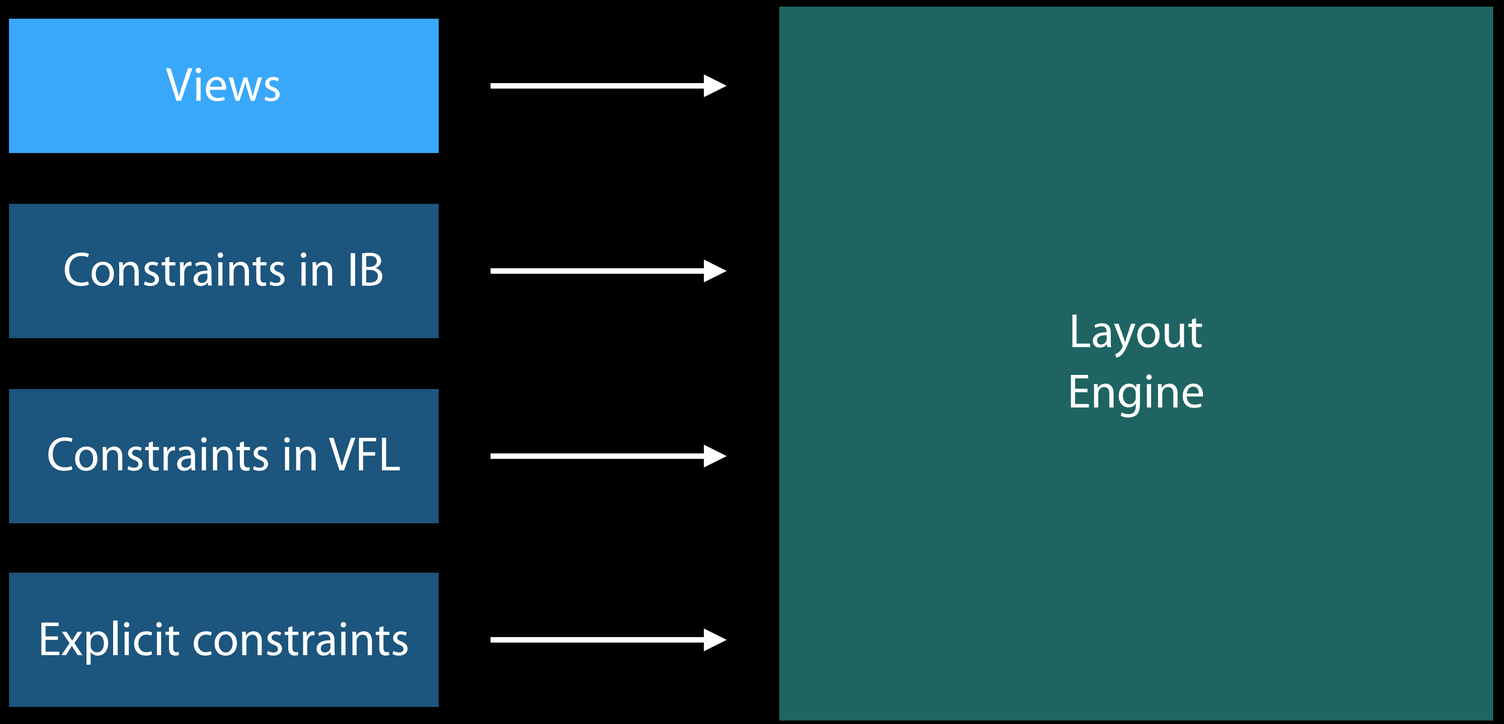
View Sizing

Certain views have an `intrinsicContentSize`

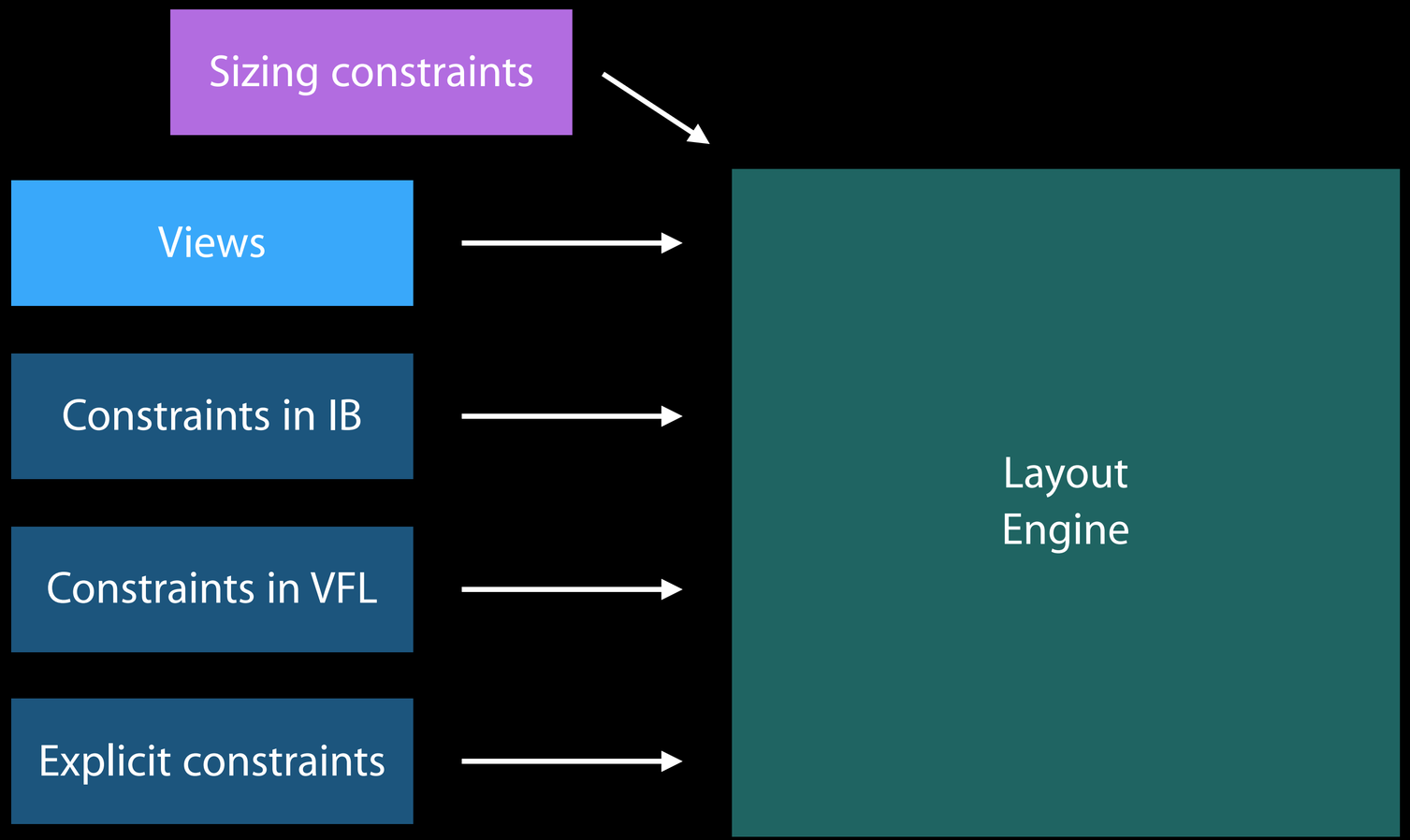
Constraints should define size when possible

For self-sizing views, define size fully in constraints

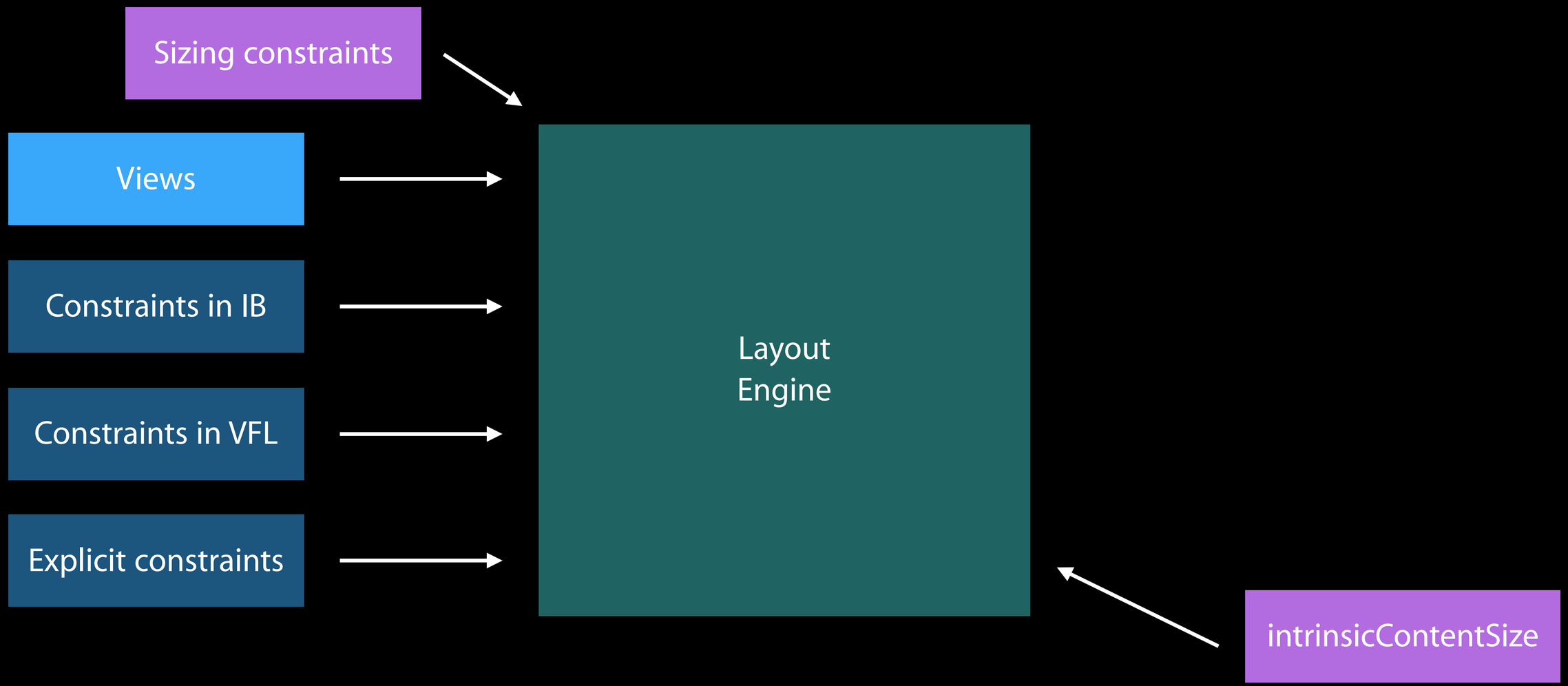
Building the Layout



Building the Layout



Building the Layout

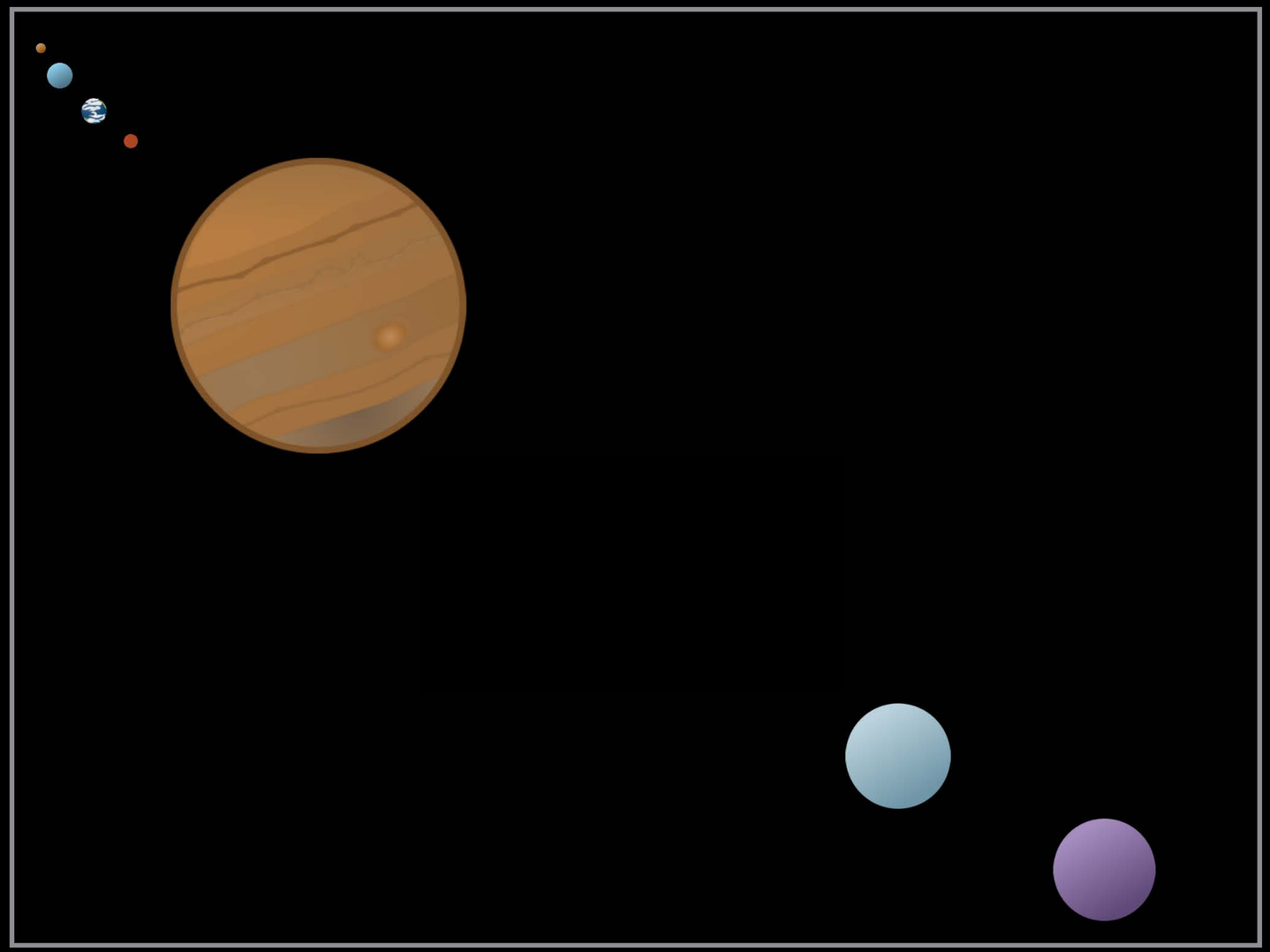


Priorities

Mystery #5

Ambiguity

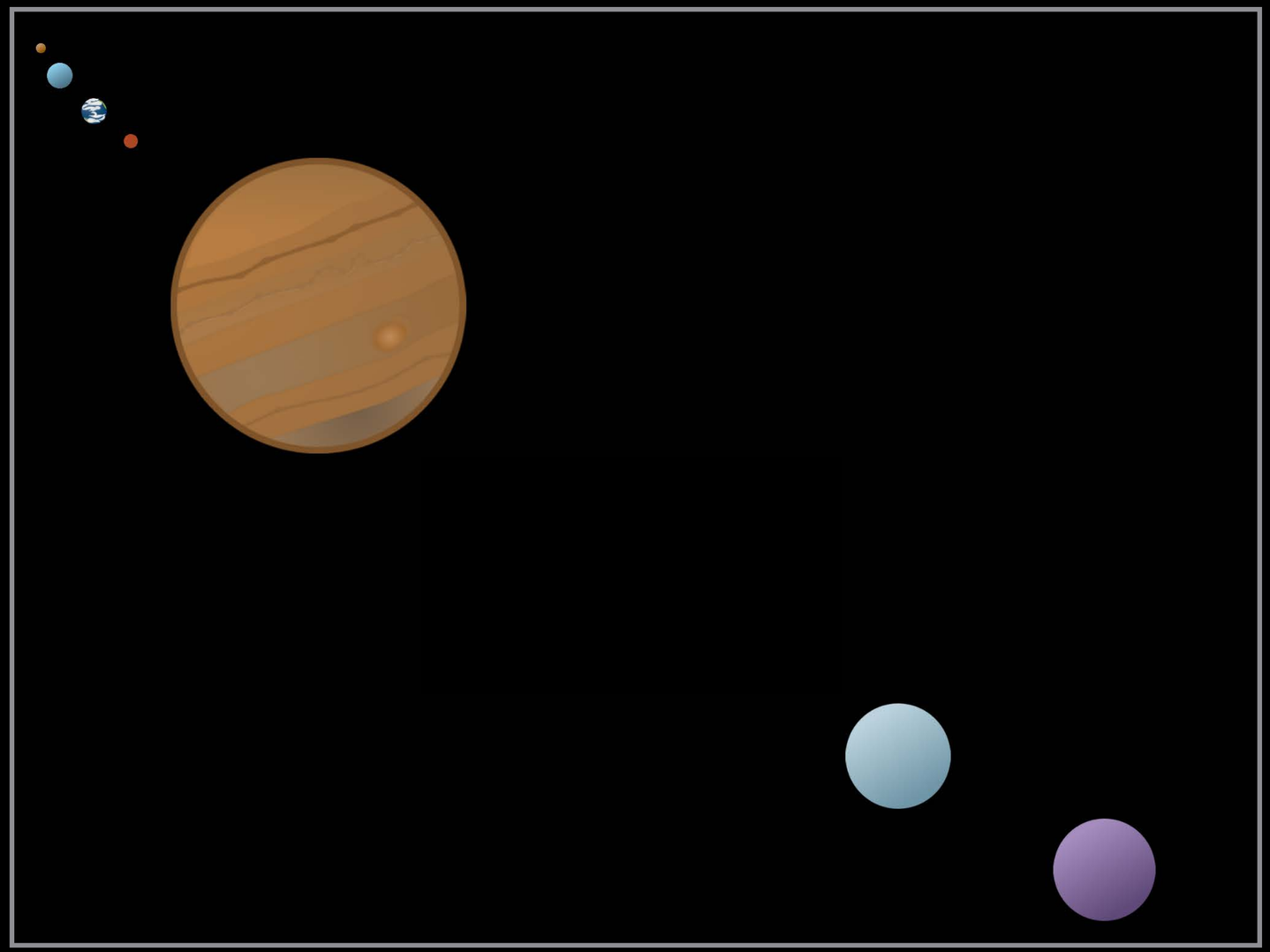
Why does it happen?



Ambiguity

Why does it happen?

More than one layout solution

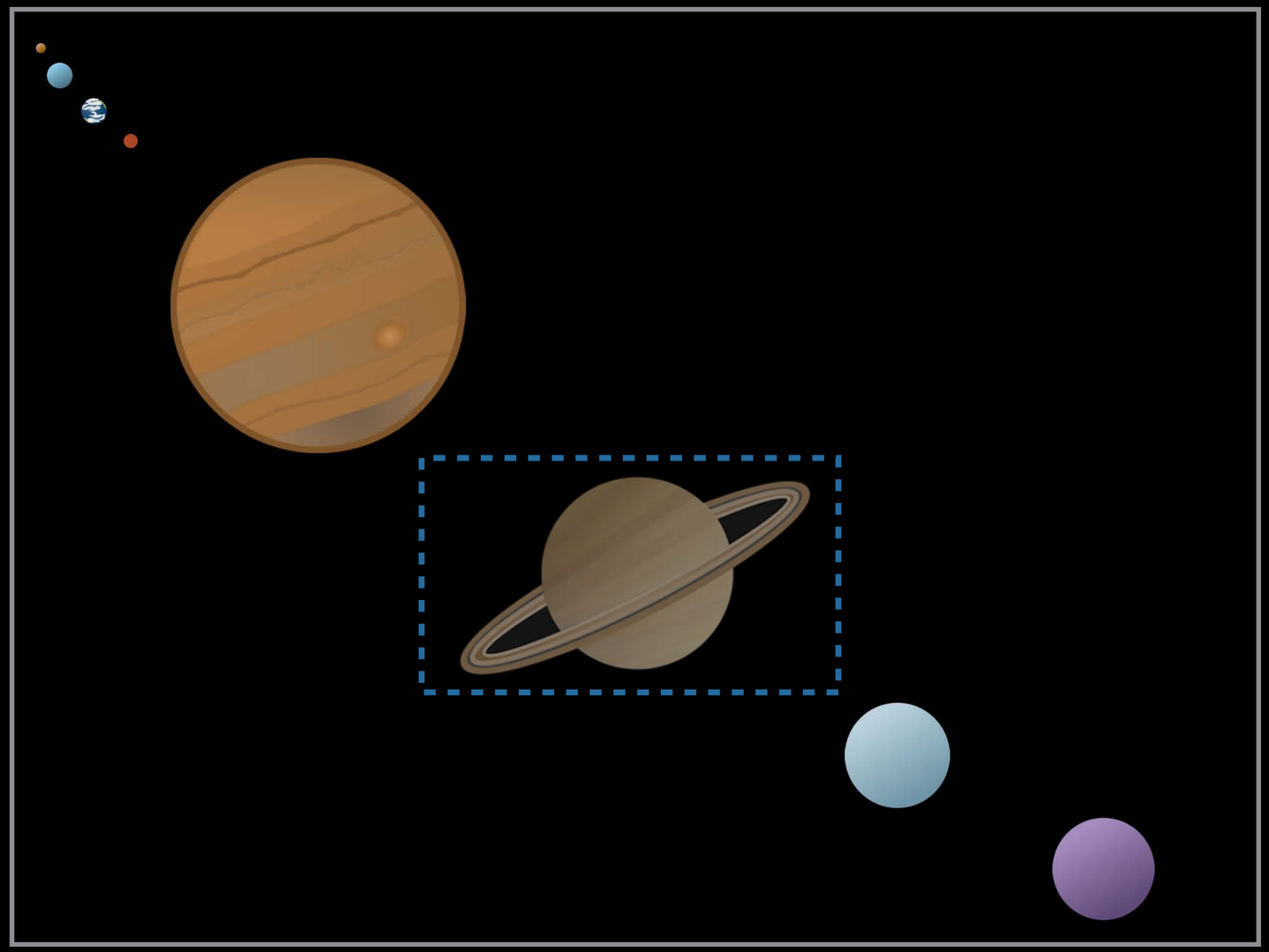


Ambiguity

Why does it happen?

More than one layout solution

- Not enough constraints

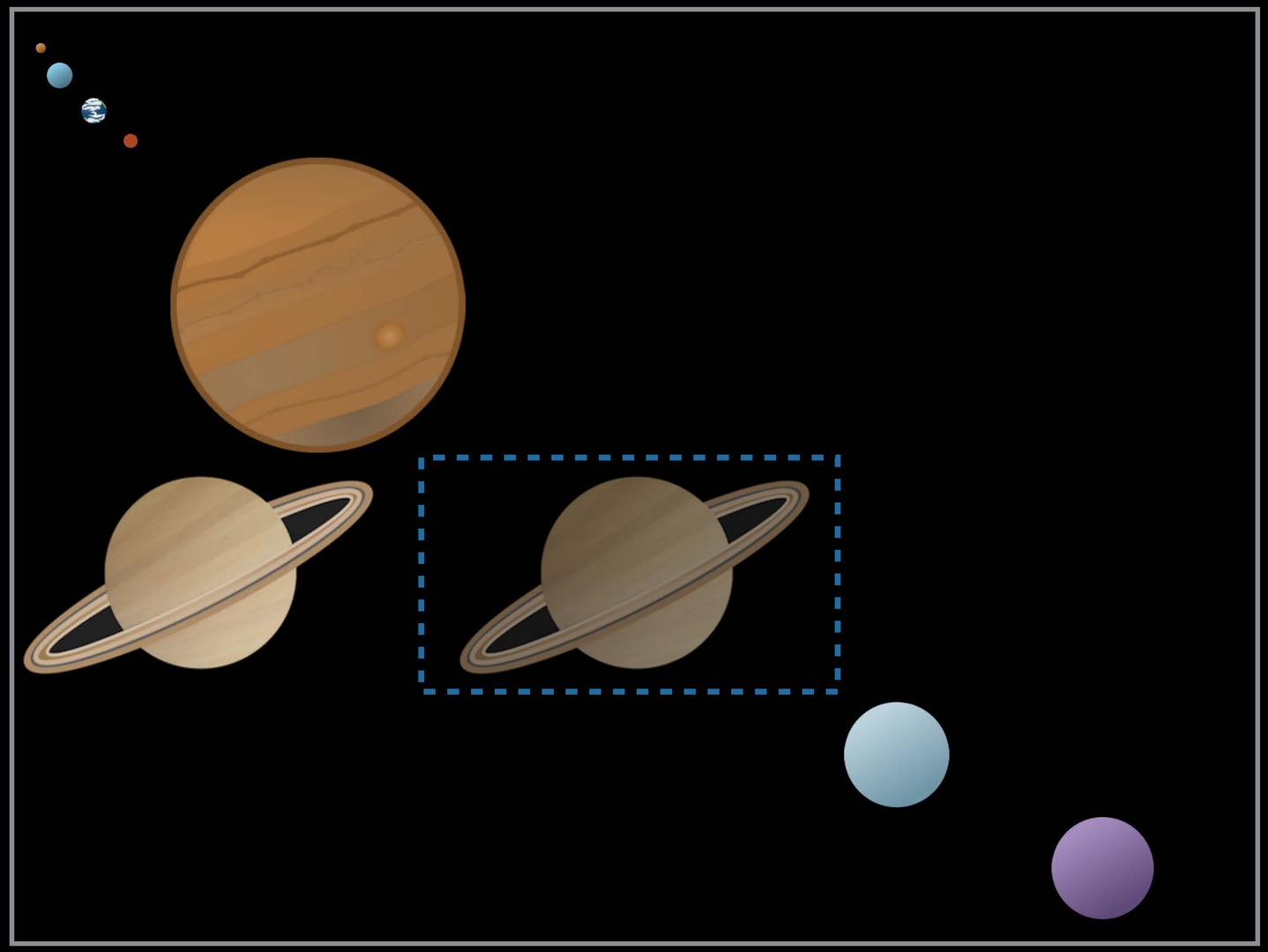


Ambiguity

Why does it happen?

More than one layout solution

- Not enough constraints



Ambiguity

Why does it happen?

More than one layout solution

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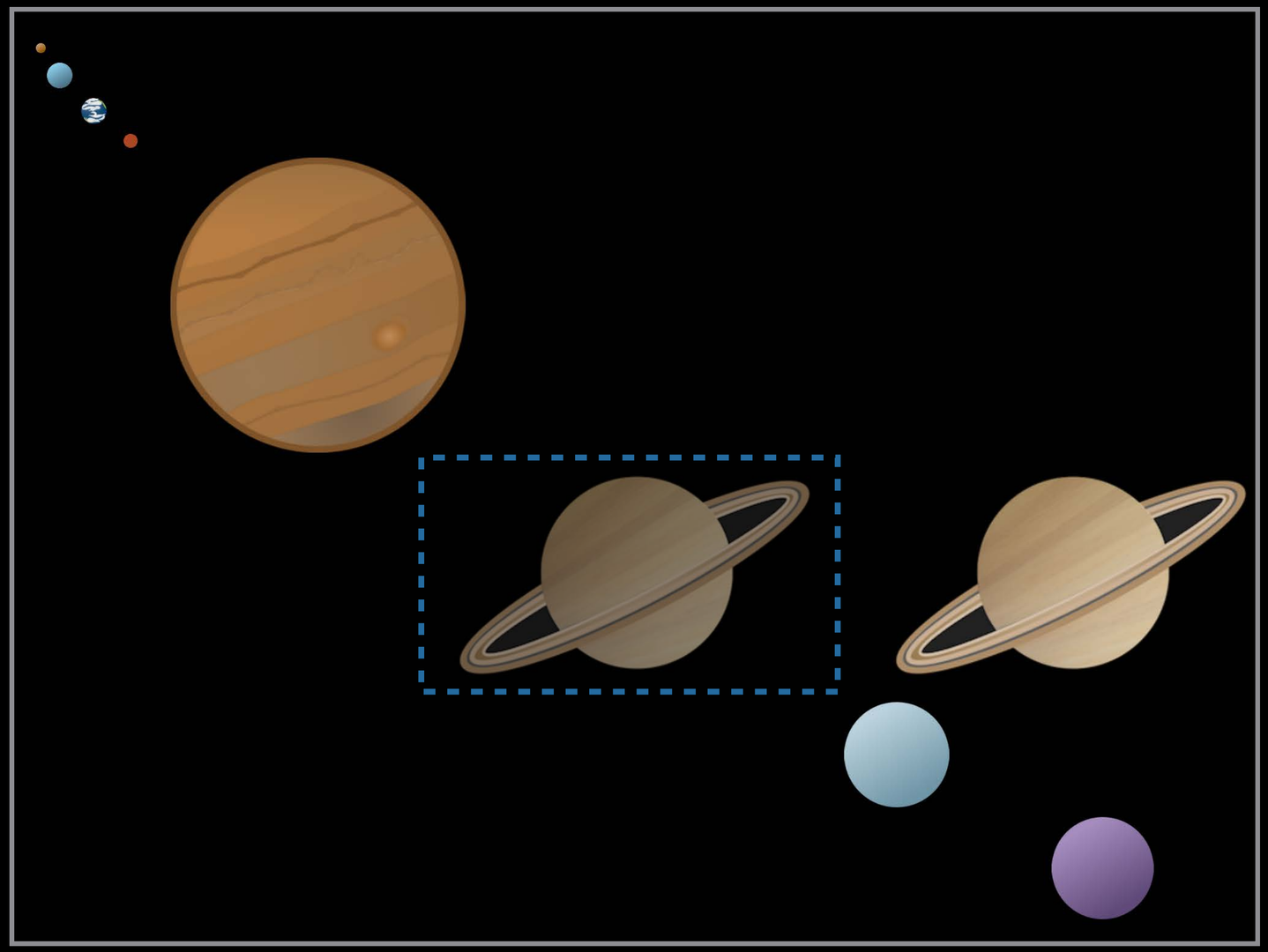
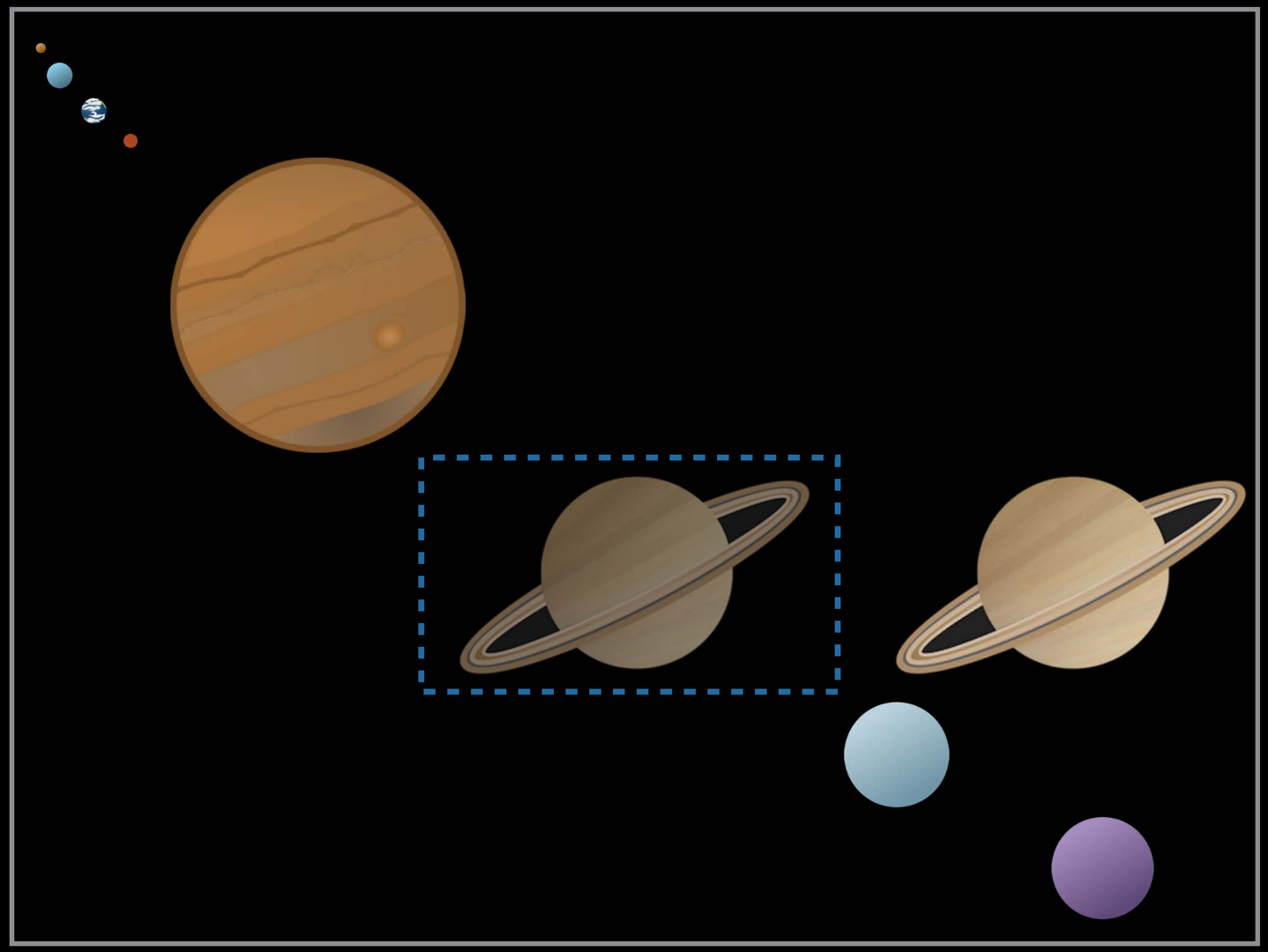


Ambiguity

Why does it happen?

More than one layout solution

- Not enough constraints
- Equal, non-required priorities



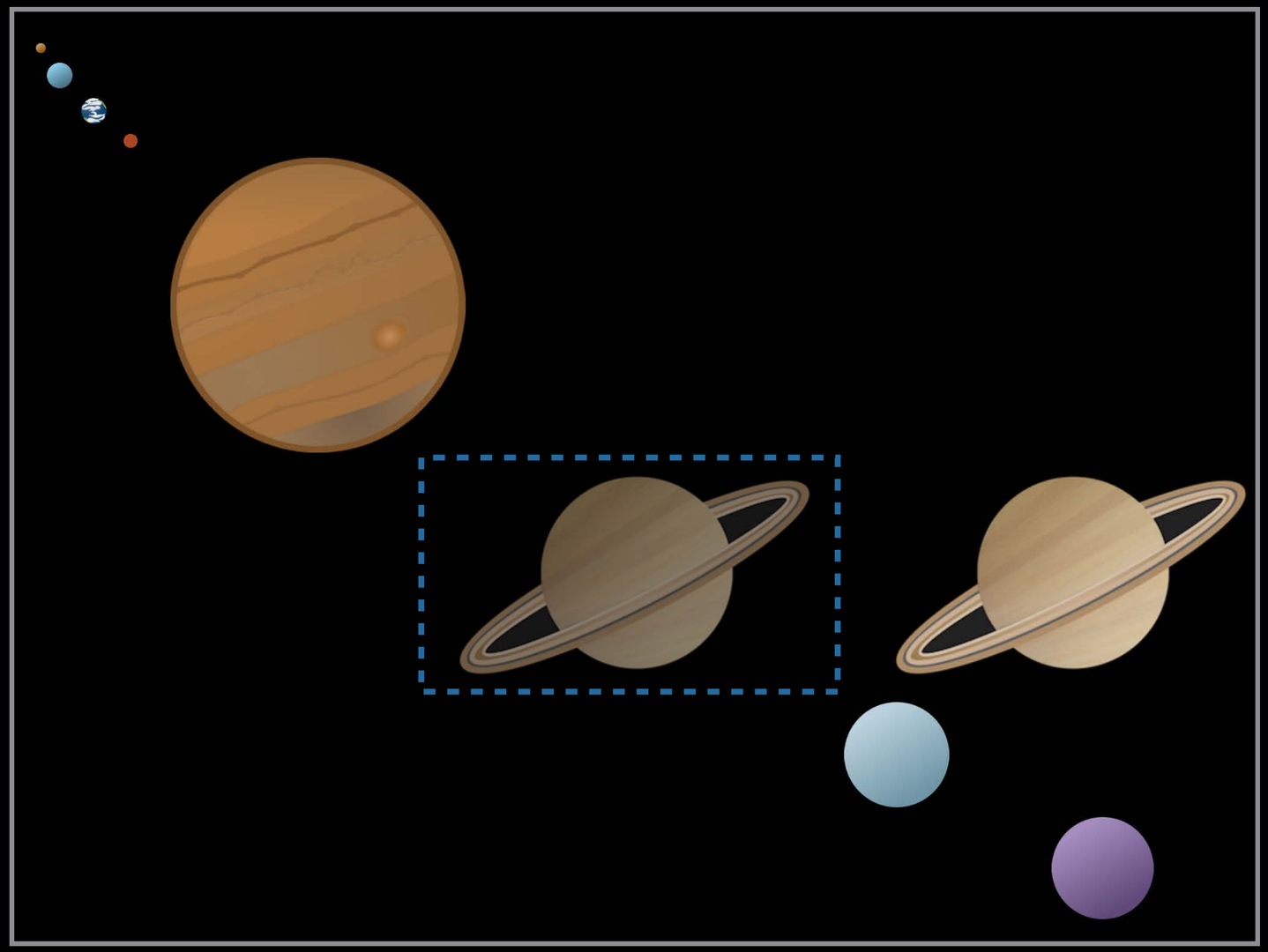
Ambiguity

Why does it happen?

More than one layout solution

- Not enough constraints
- Equal, non-required priorities

The engine makes a choice



Constraint Priorities

Constraint Priorities

Priorities go from 1–1000

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Required is 1000

DefaultHigh is 750

DefaultLow is 250

Constraint Priorities

Priorities go from 1–1000

Required is 1000

DefaultHigh is 750

DefaultLow is 250

```
@"H:|-[image]-|"
@"V:|-[image]-[caption(==image@751)]-|"
```

Constraint Priorities

Priorities go from 1–1000

Required is 1000

DefaultHigh is 750

DefaultLow is 250

```
@"H:|-[image]-|"
@"V:|-[image]-[caption(==image@751)]-|"
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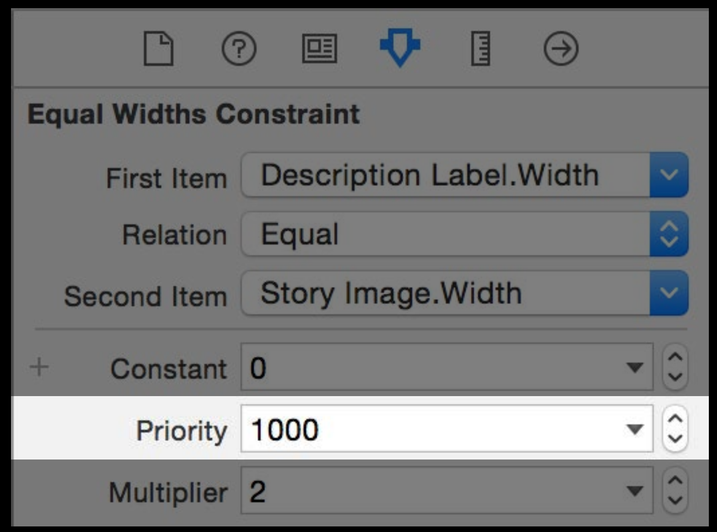

Constraint Priorities

Priorities go from 1–1000

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@"H:|-[image]-|"
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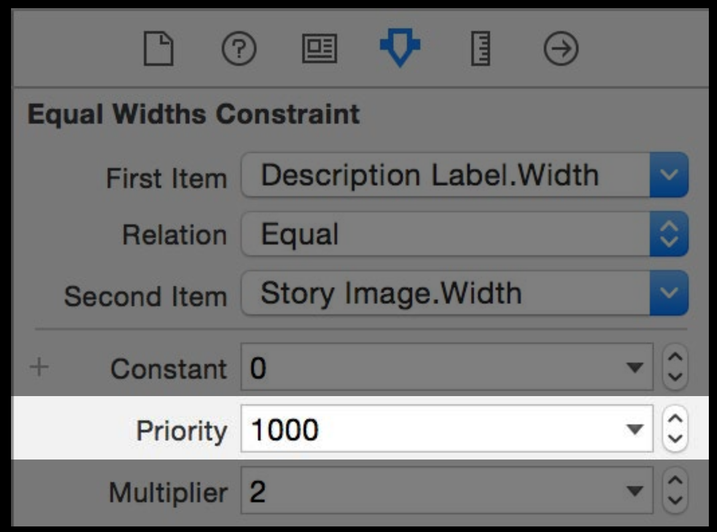


```
widthConstraint.priority =
        UILayoutPriorityDefaultHigh + 10;
```

Constraint Priorities

Priorities go from 1–1000

Required is 1000

DefaultHigh is 750

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Highest priority wins

```
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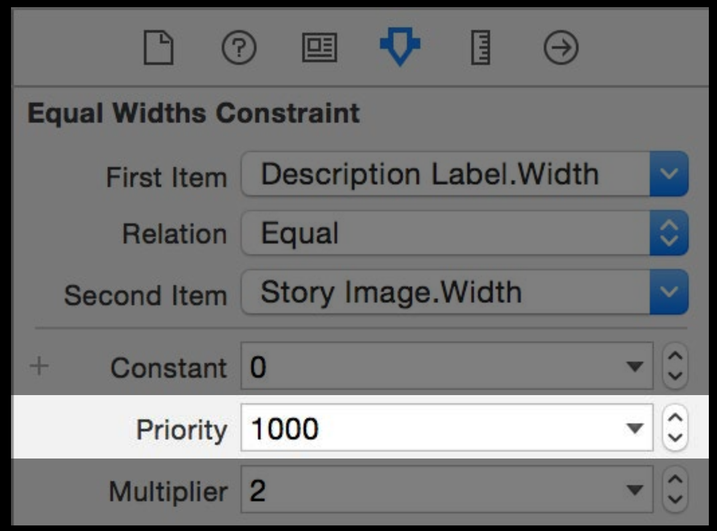


```
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```

Constraint Priorities

Priorities go from 1–1000

Required is 1000

DefaultHigh is 750

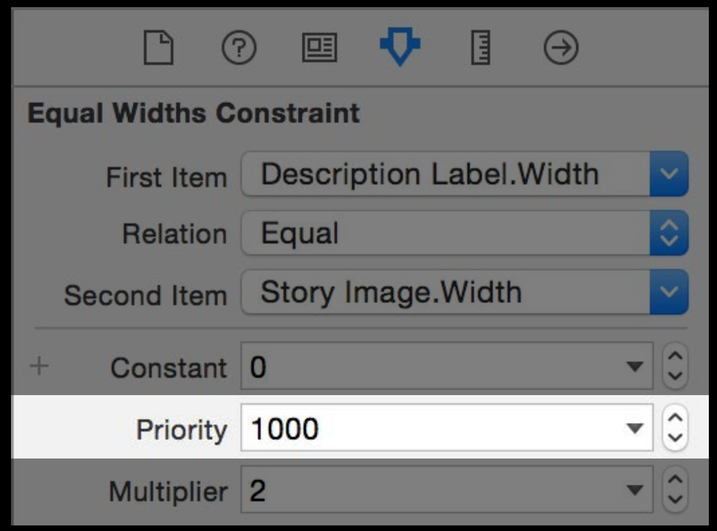
DefaultLow is 250

Highest priority wins

System uses some priorities

- Set around, not equal to

```
@"H:|-[image]-|"
@"V:|-[image]-[caption(==image@751)]-|"
```

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Content Priorities

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How a view handles its content

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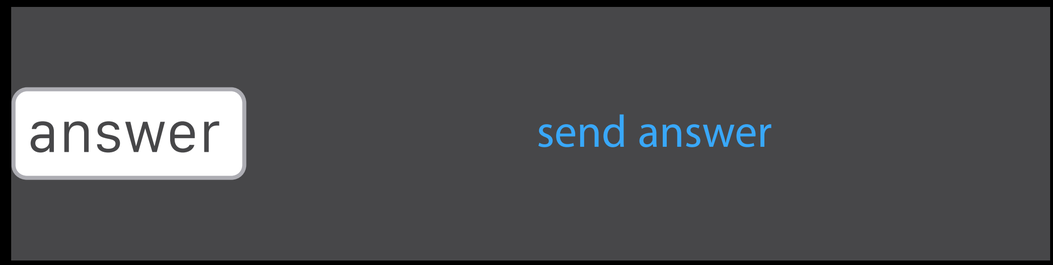
- Content hugging



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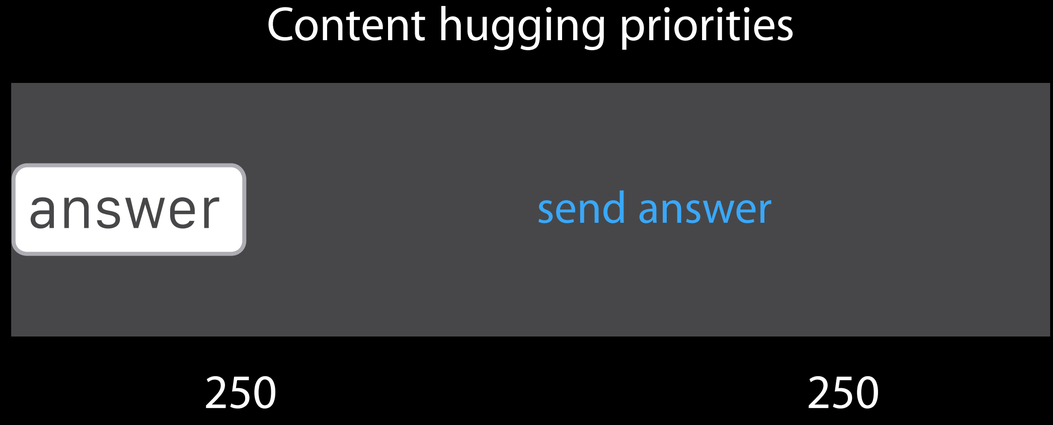

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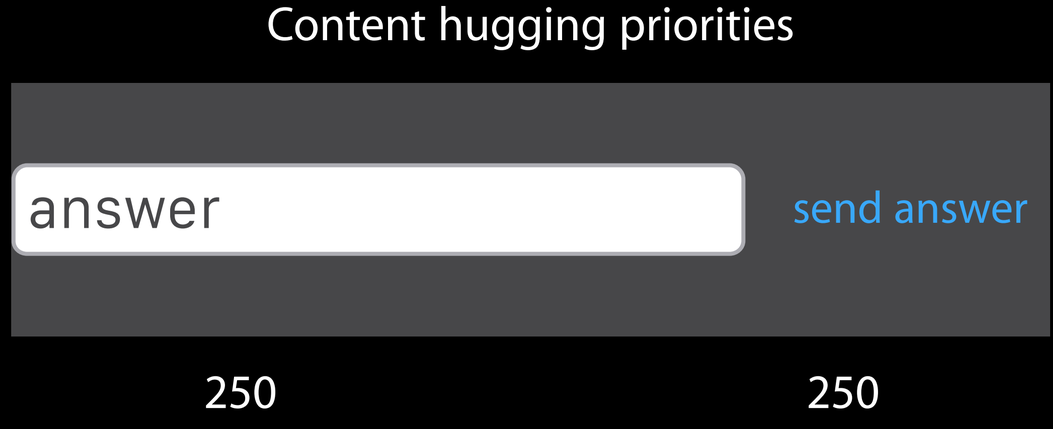

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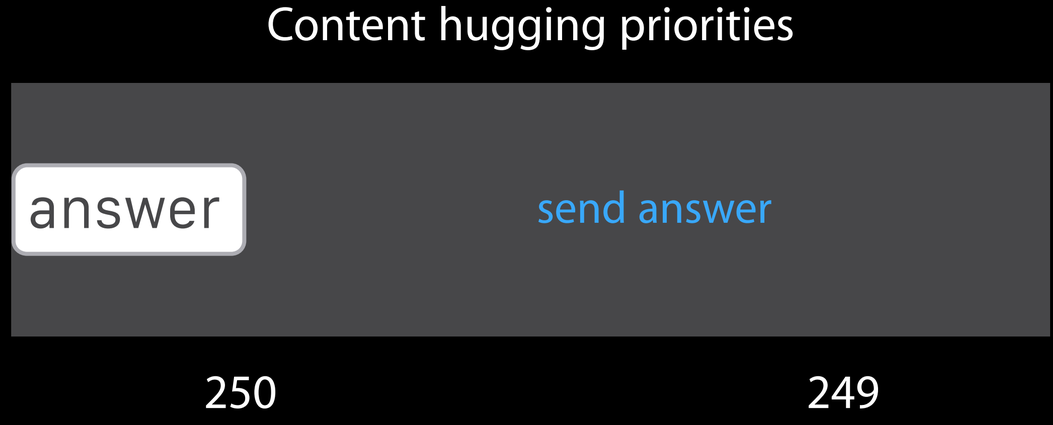

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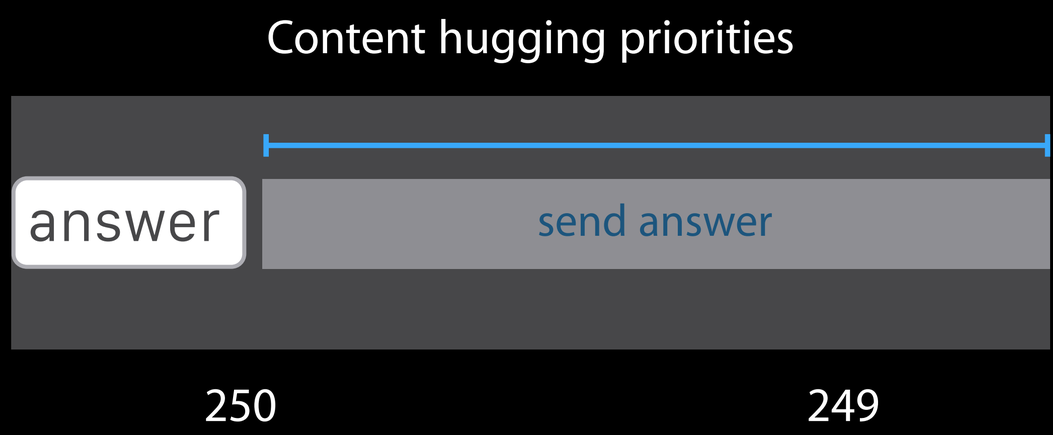

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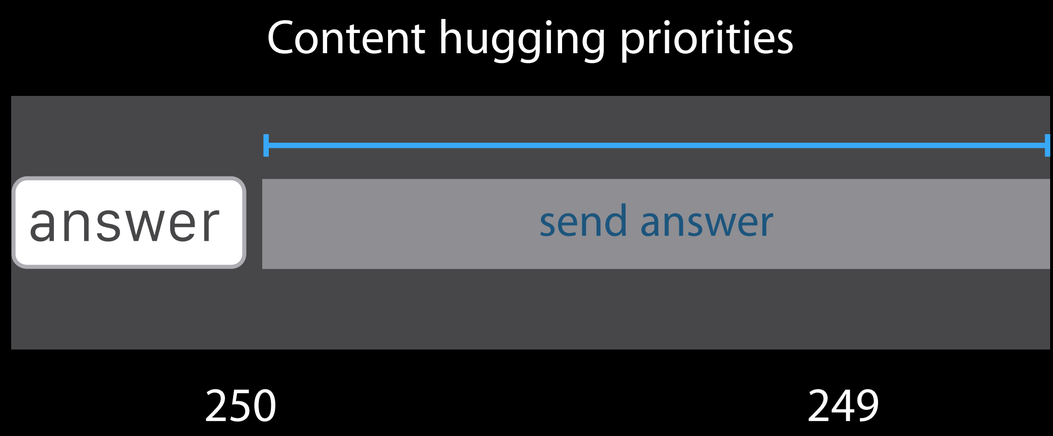

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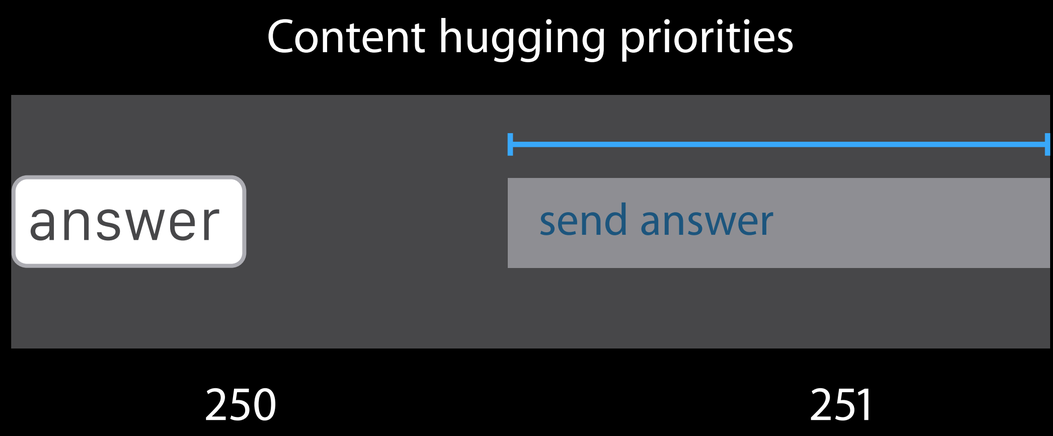

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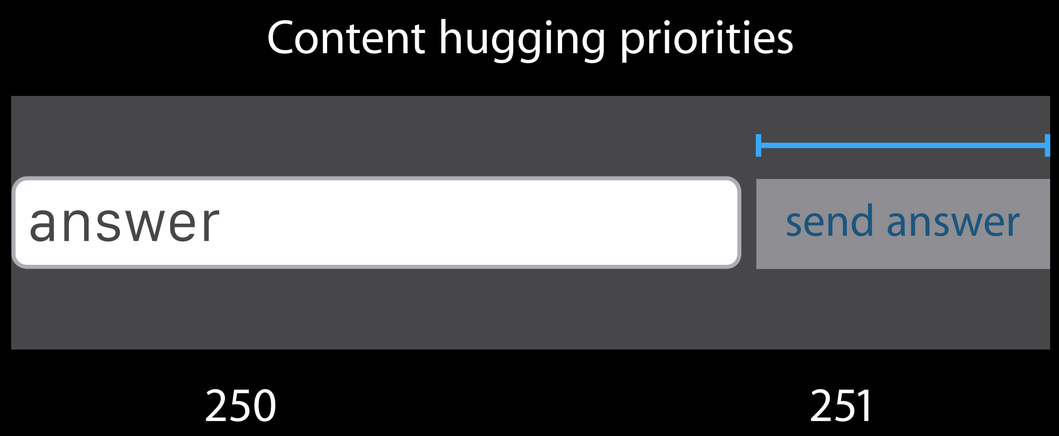

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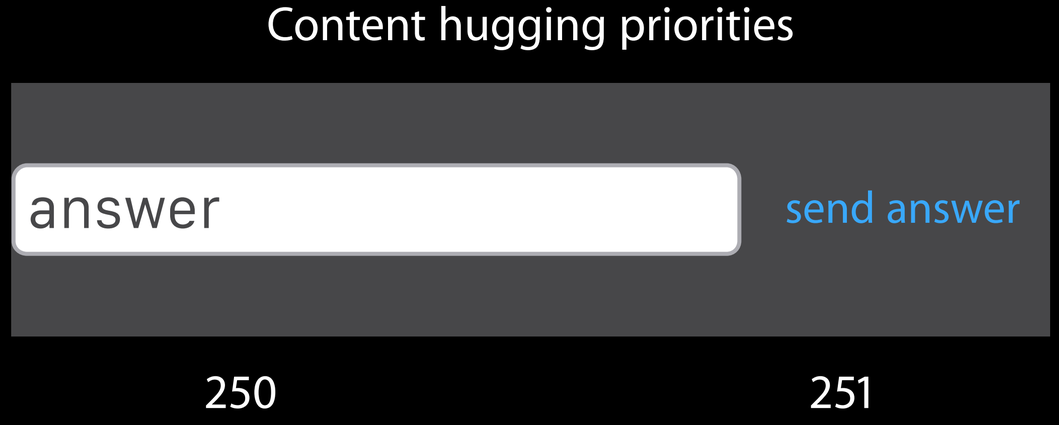

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- Compression resistance

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Compression resistance priorities

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Compression resistance priorities

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Types

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Compression resistance priorities

750 751

Priorities

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Can help keep constraints from unsatisfiability

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- But look out for competing priorities!

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Use content priorities to get to the right layout

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- Hugging priorities hug content

Priorities

Can help keep constraints from unsatisfiability

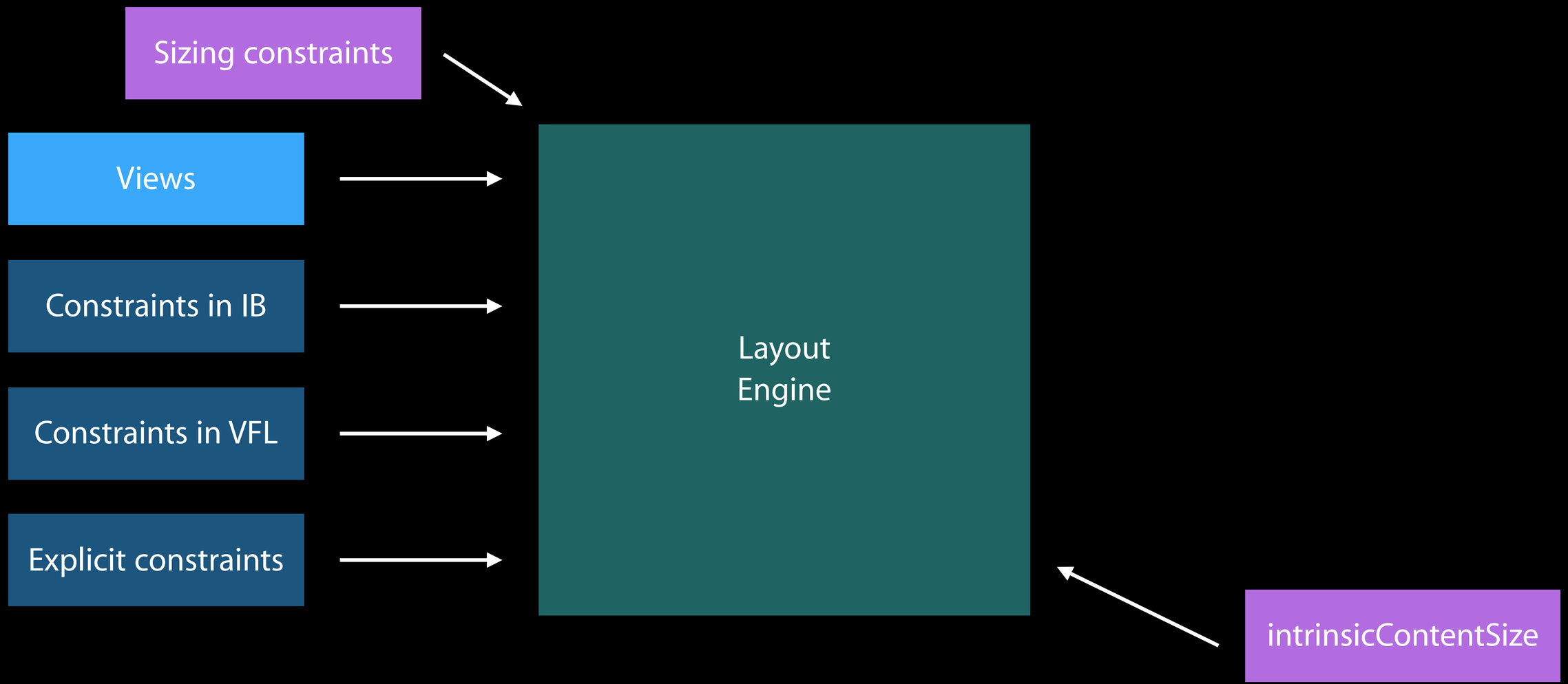
- But look out for competing priorities!

Results are more consistent

Use content priorities to get to the right layout

- Hugging priorities hug content
- Compression resistance resists squishing

Building the Layout



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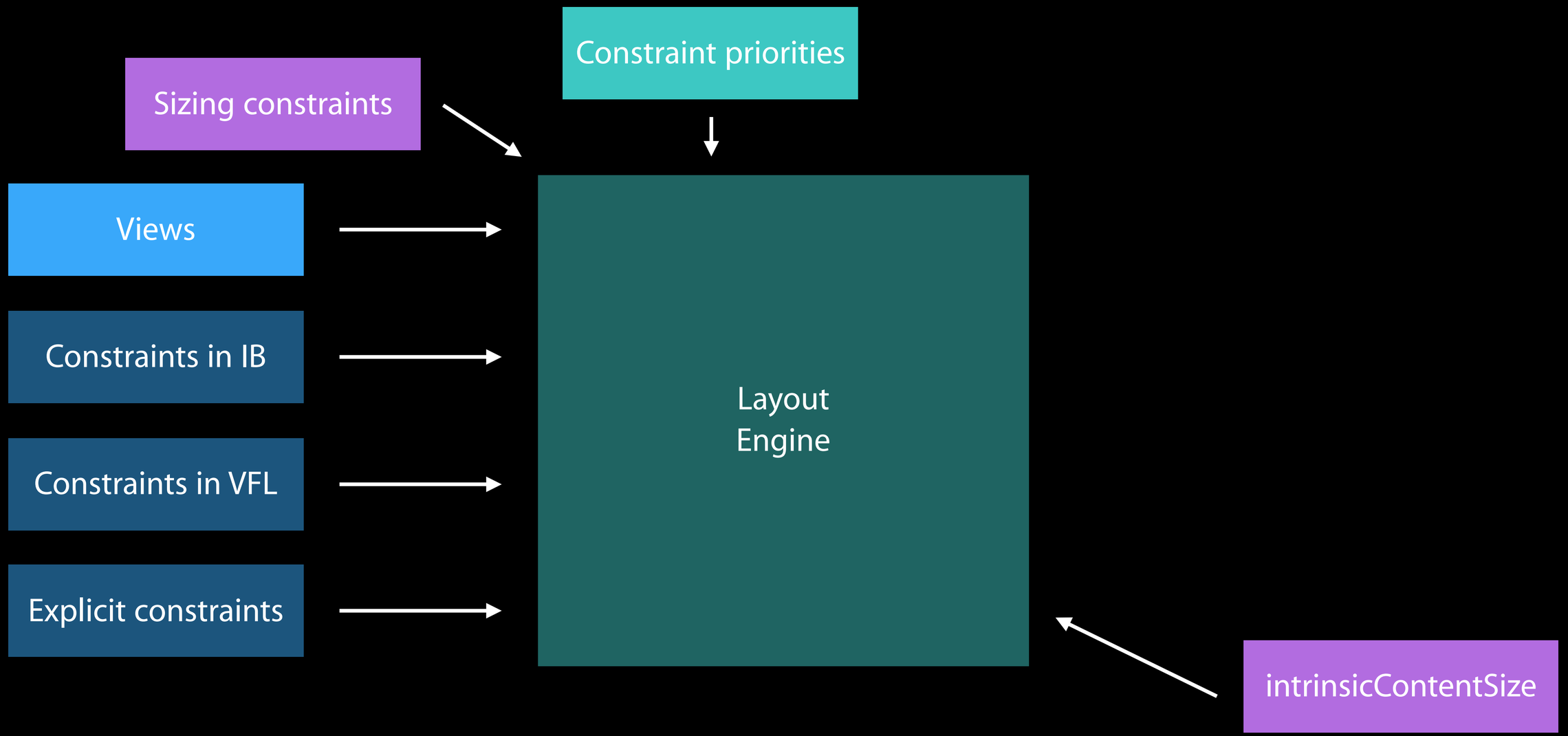

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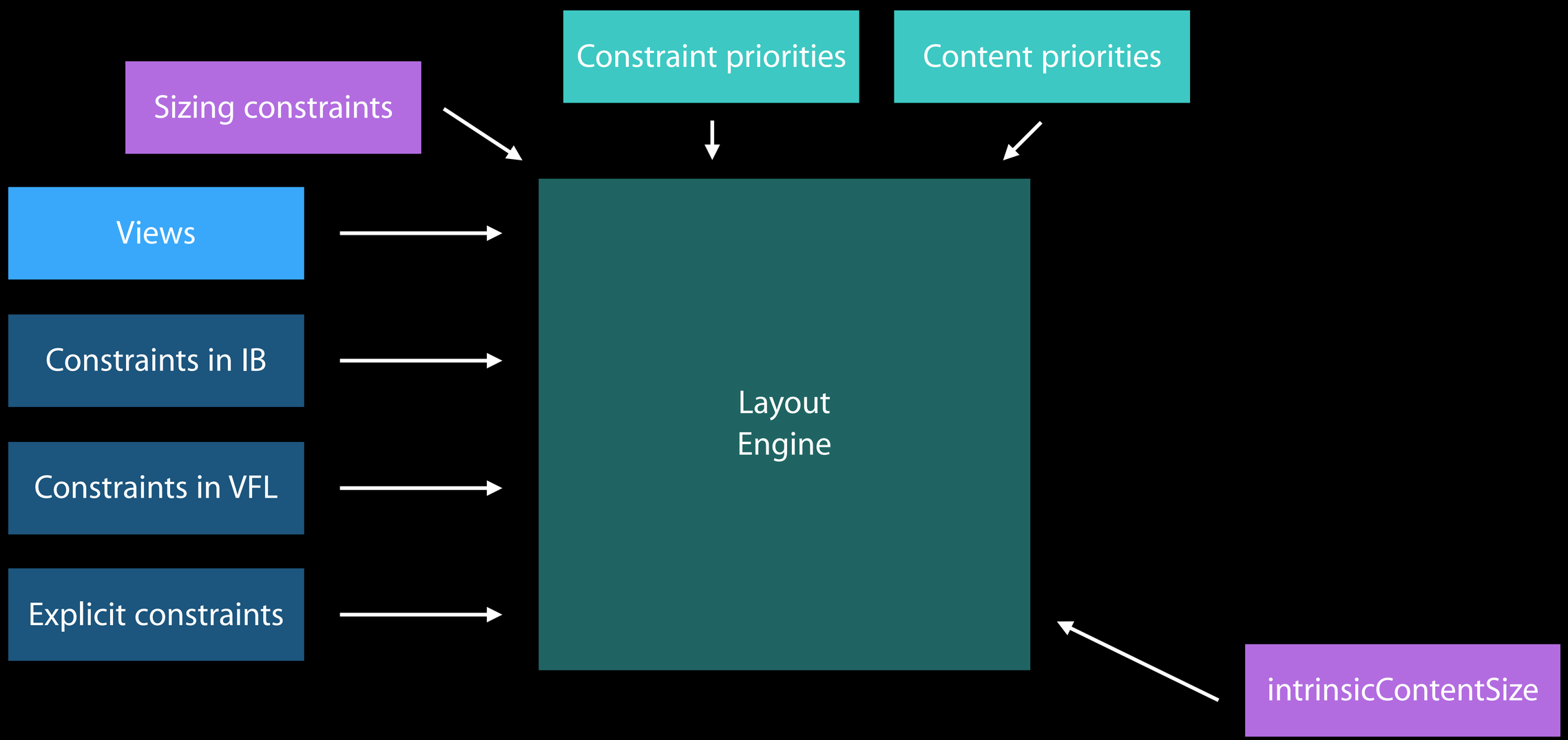

Alignment

Mystery #6

Aligning Baselines

Aligning Baselines

Use `firstBaseline` and `lastBaseline`

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Aligns text better than top or bottom

Aligning Baselines

Use `firstBaseline` and `lastBaseline`

Aligns text better than top or bottom

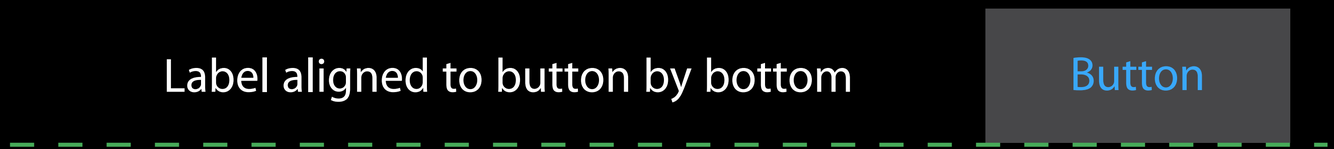
Better control over changing views

Aligning Baselines

Use **`firstBaseline`** and **`lastBaseline`**

Aligns text better than top or bottom

Better control over changing views

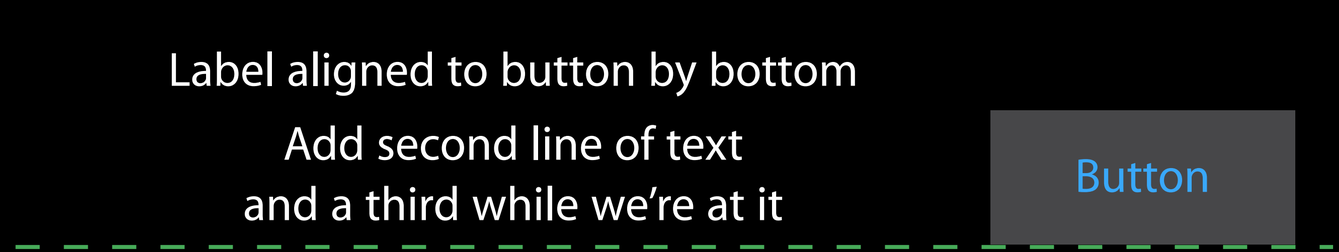


Aligning Baselines

Use `firstBaseline` and `lastBaseline`

Aligns text better than top or bottom

Better control over changing views



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Better control over changing views

Label aligned to button by bottom

Add second line of text
and a third while we're at it

Button

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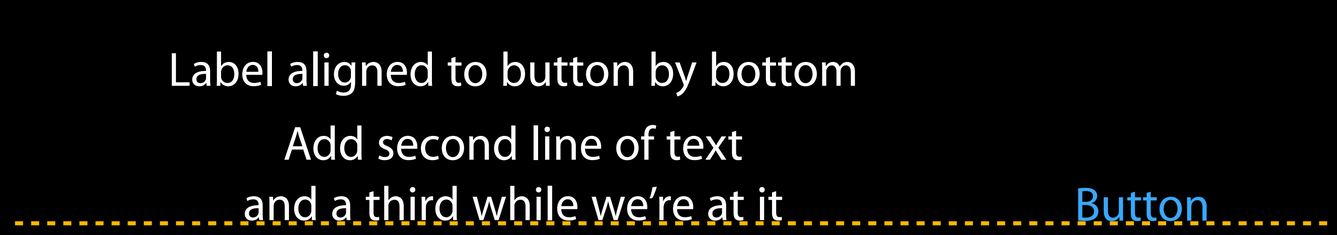

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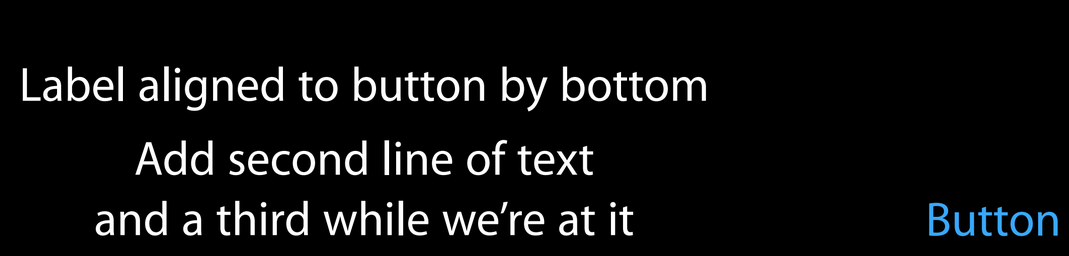

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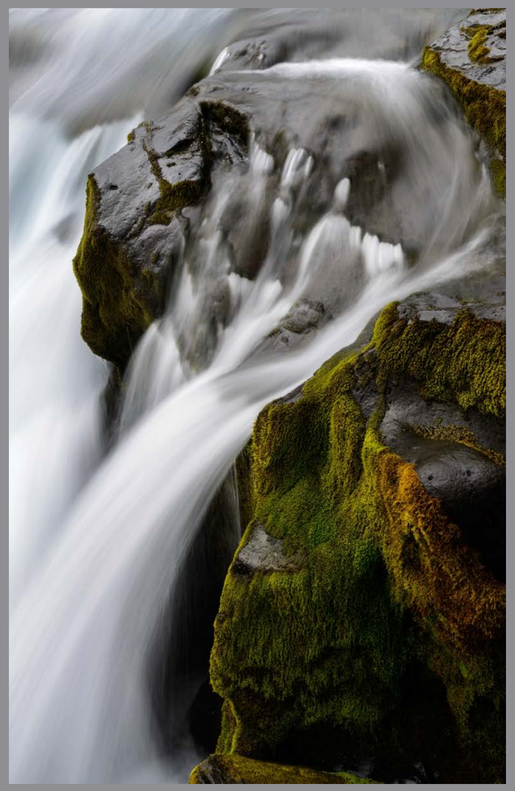
Leading and Trailing



One of the best photos I took on the trip.

I love how the water looks like mist!

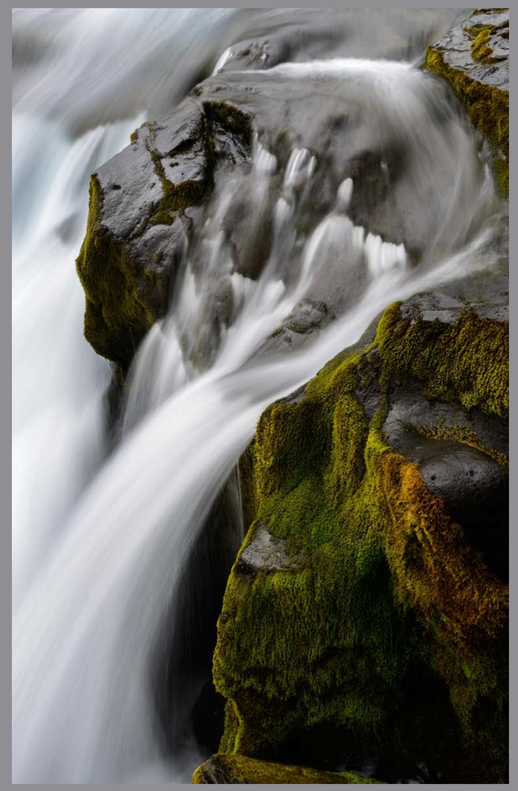
Rate: ★★★☆

Add comment

Leading and Trailing

Use leading/trailing instead of left/right

Helps with prep for localization



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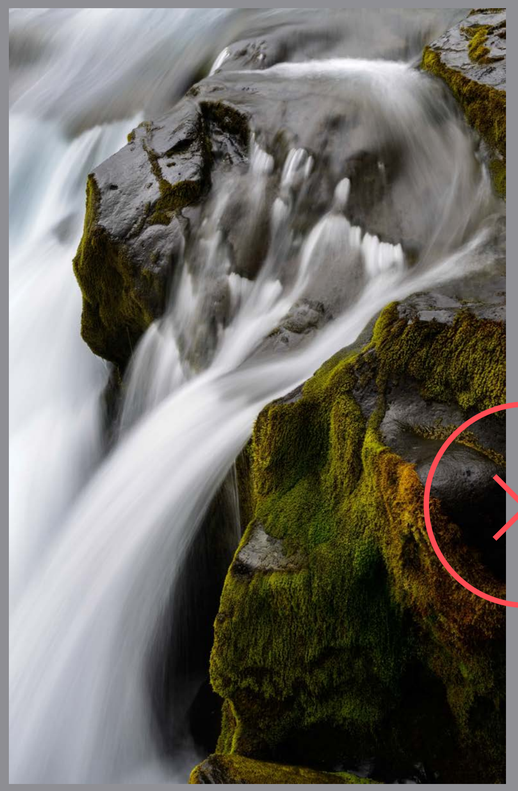
Tied to left and right



یکی از بهترین عکس
هایی که در سفر گرفتم.

حالت آب را که شبیه مه
است خیلی دوست دارم!

پیشنهاد دهید

امتیاز: ★★★☆

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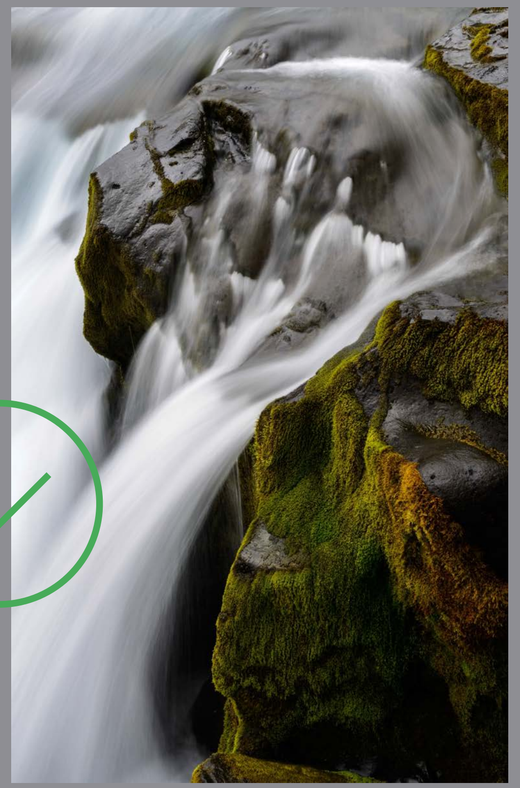

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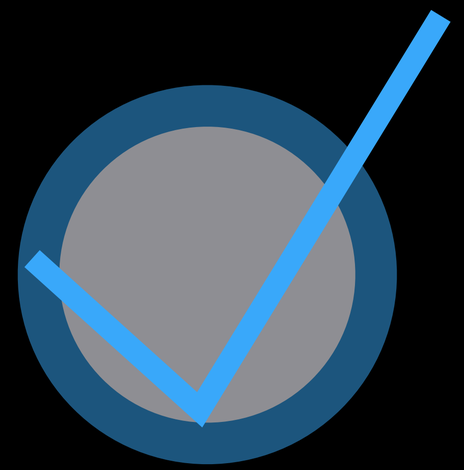
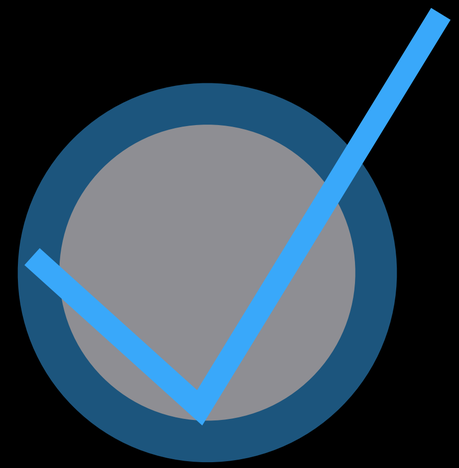
Alignment Rects



Tap to choose character

Alignment Rects

Usually (not always) same as frame



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Alignment Rects

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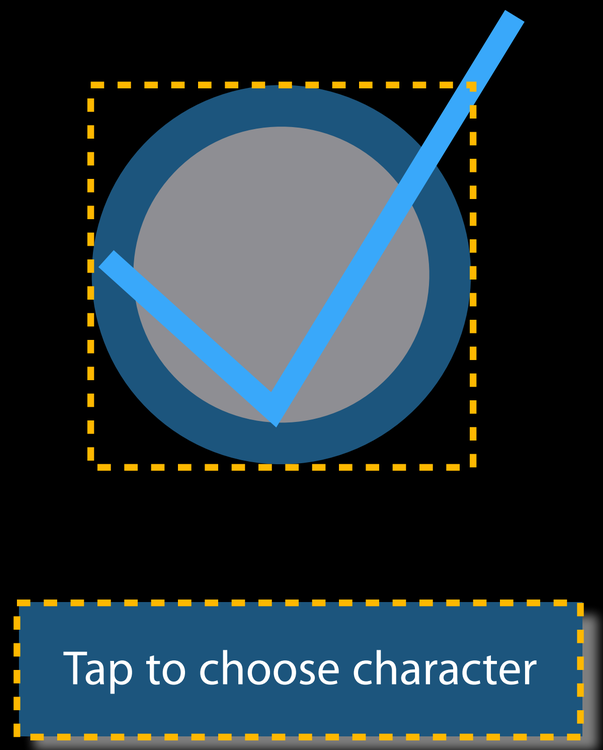
Includes the critical content only



Alignment Rects

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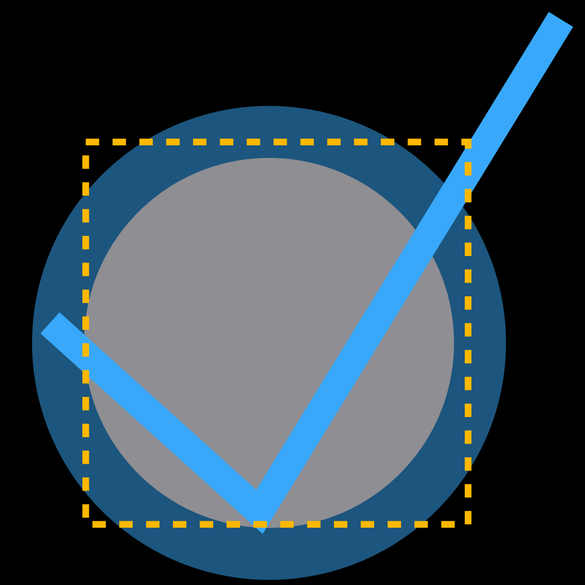

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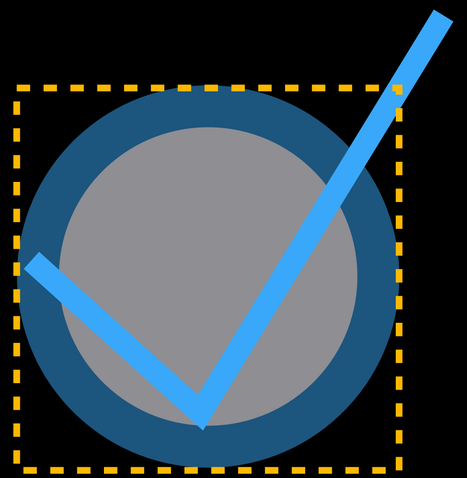

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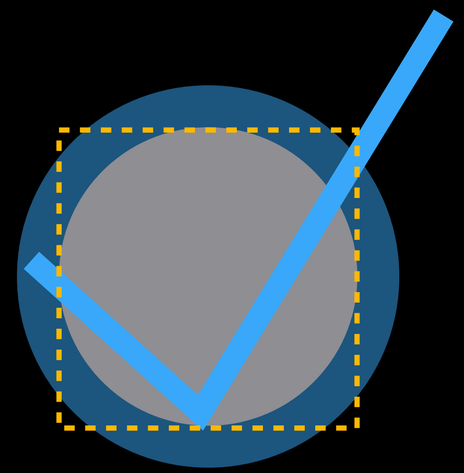
Override `alignmentRectInsets` if needed



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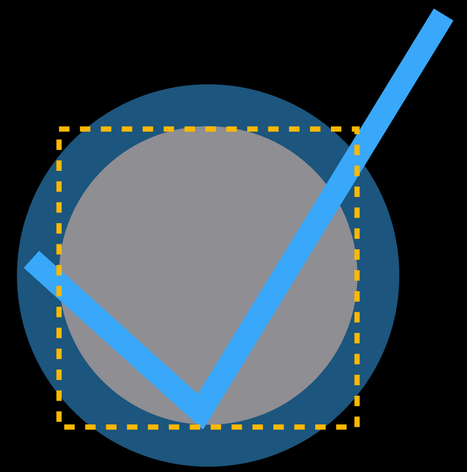
Find out the calculated rects



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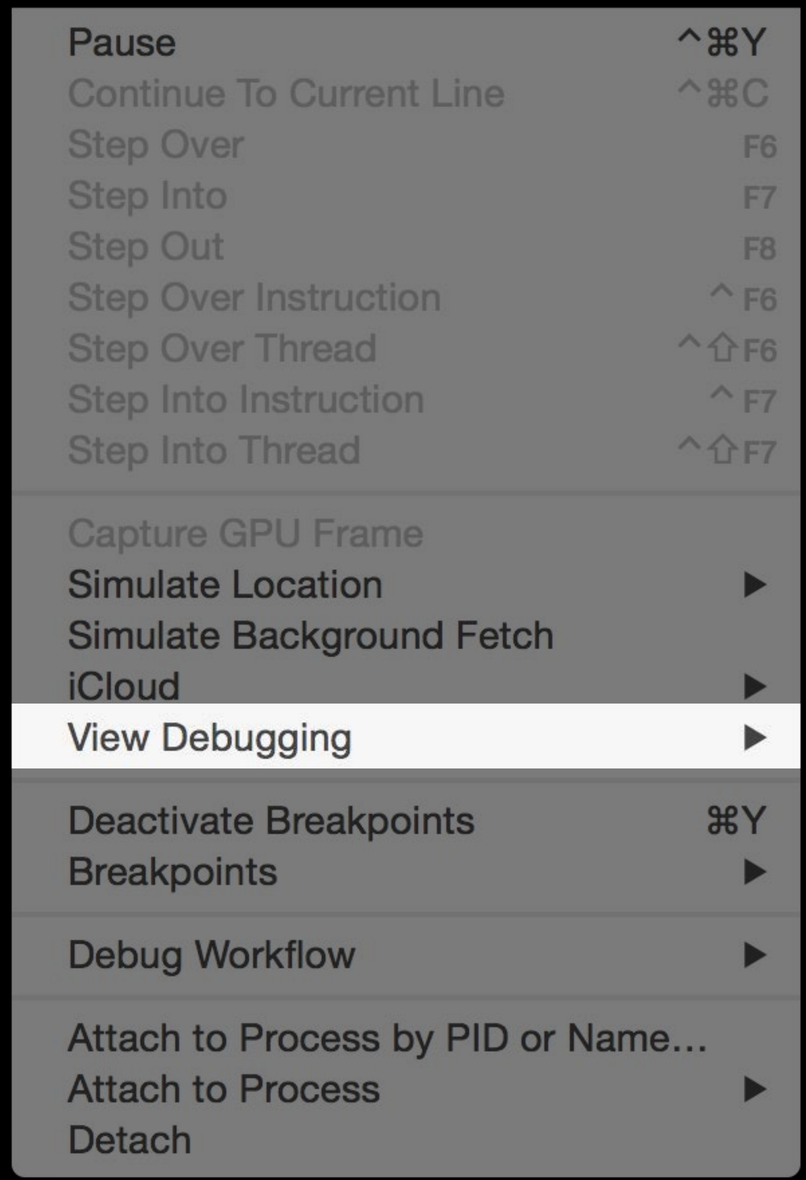

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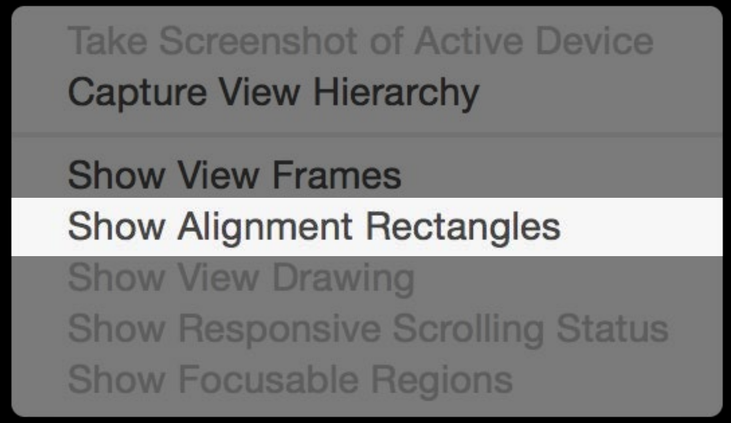

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More in Part 2

Alignment

Alignment

First and last baseline for better aligned text

Alignment

First and last baseline for better aligned text

Leading and trailing instead of left and right

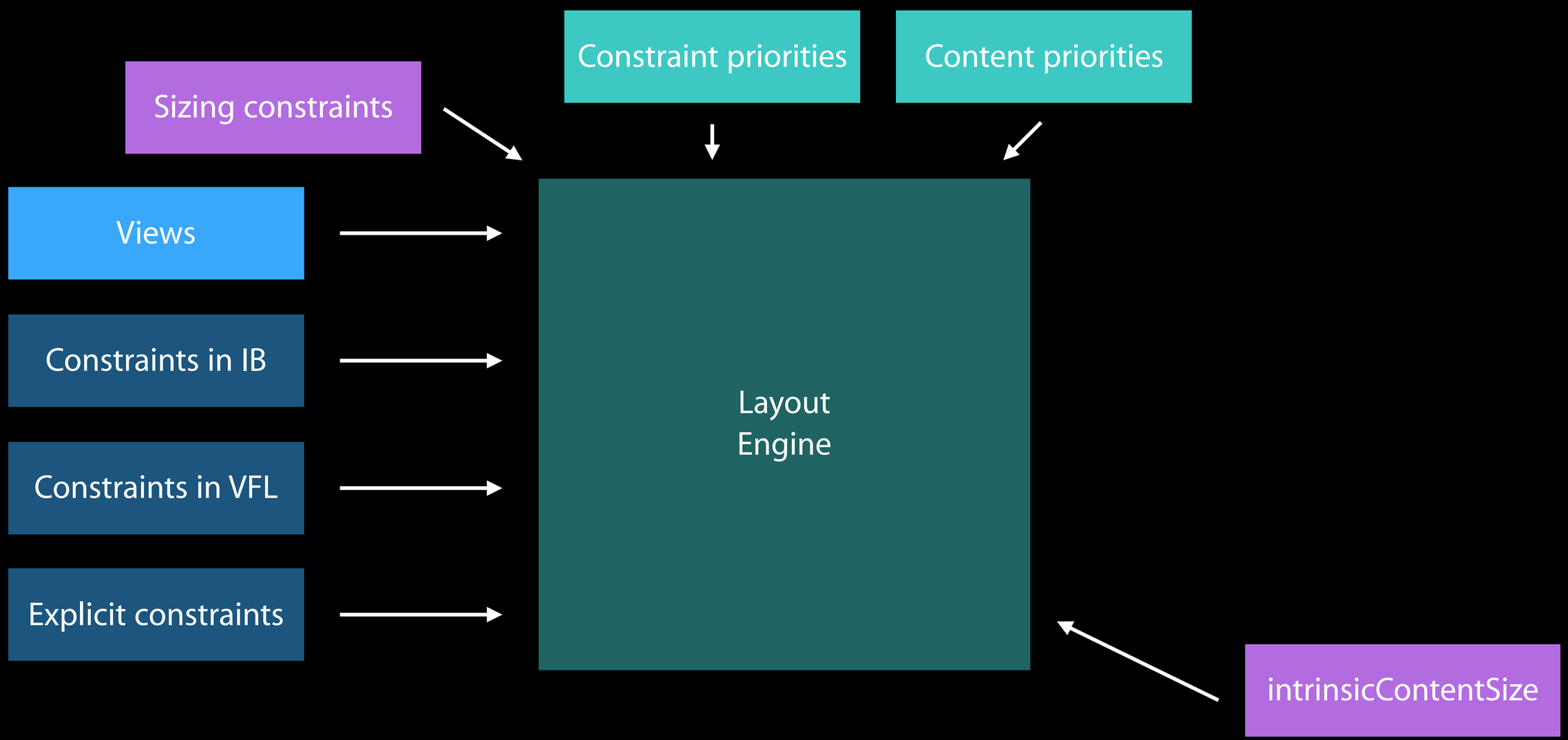
Alignment

First and last baseline for better aligned text

Leading and trailing instead of left and right

Override `alignmentRectInsets` to adjust alignment rects

Building the Layout



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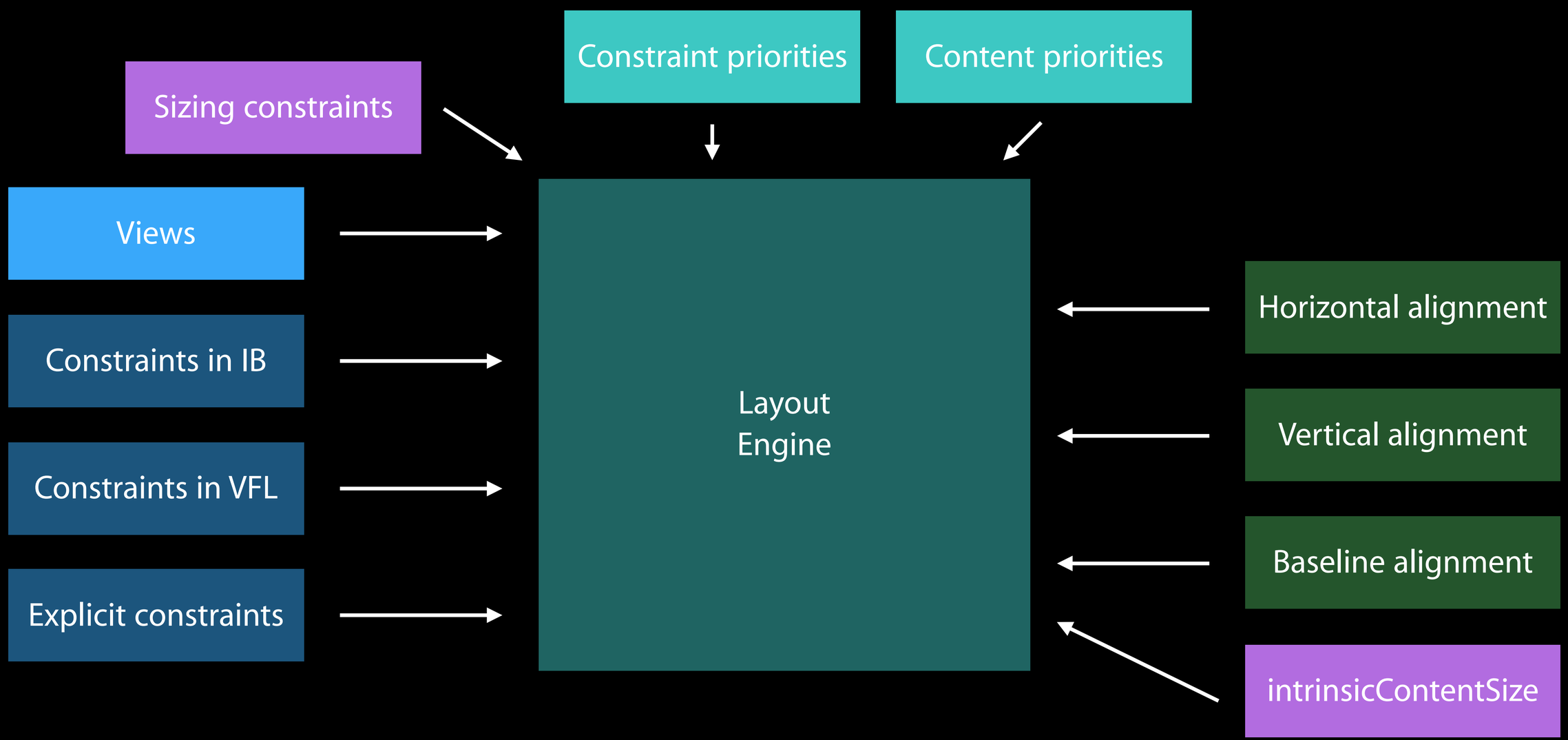

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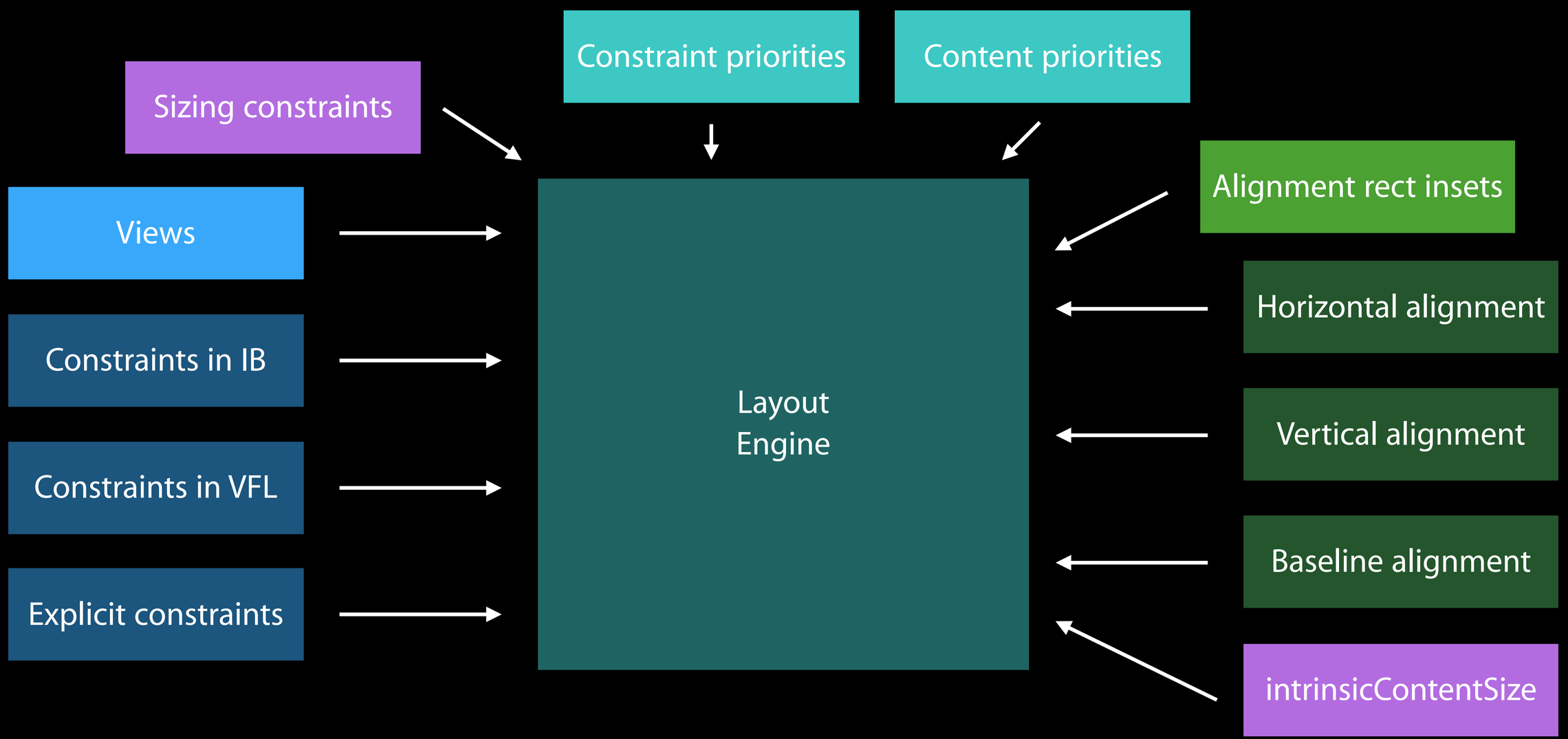
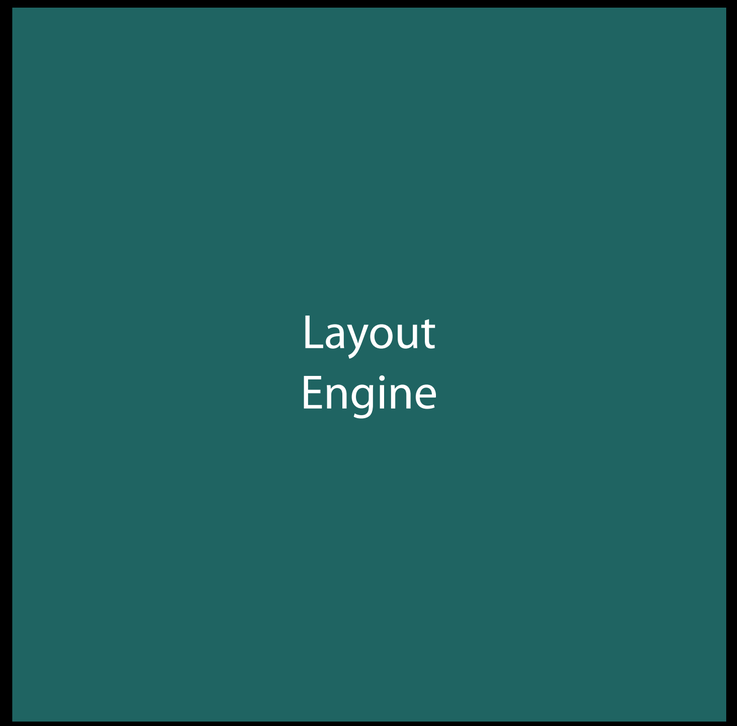


Building the Layout



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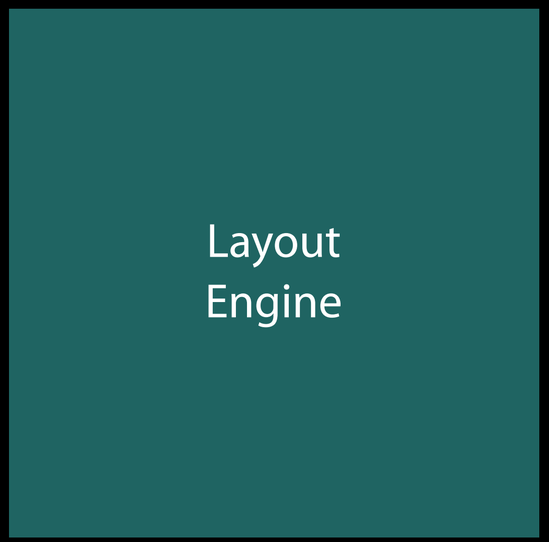

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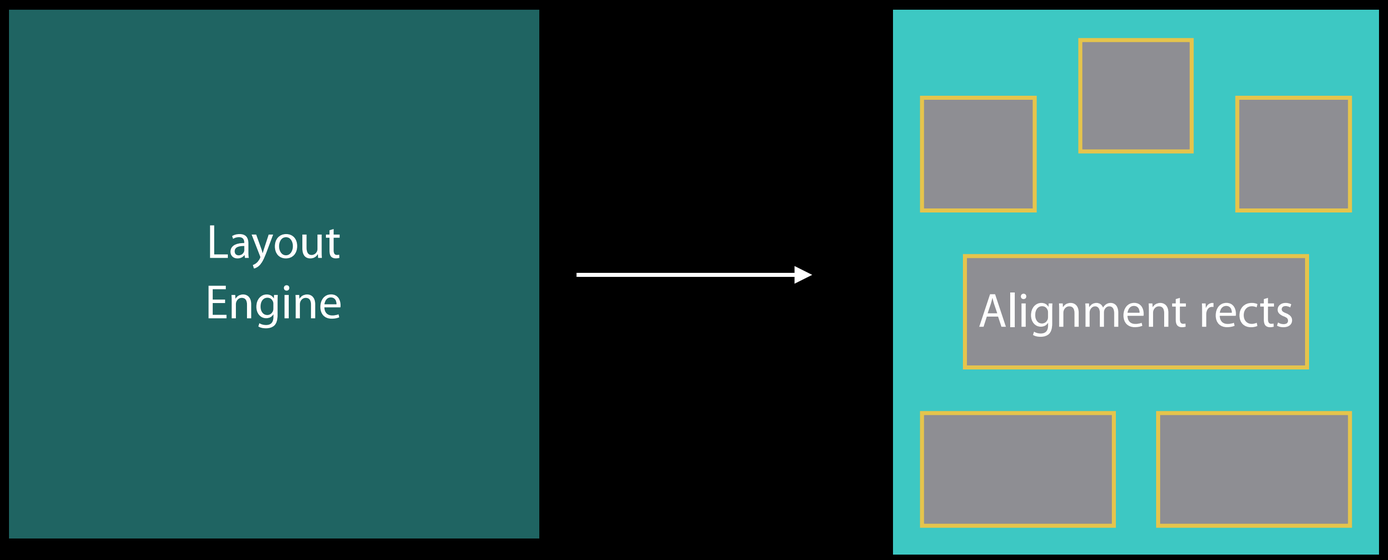

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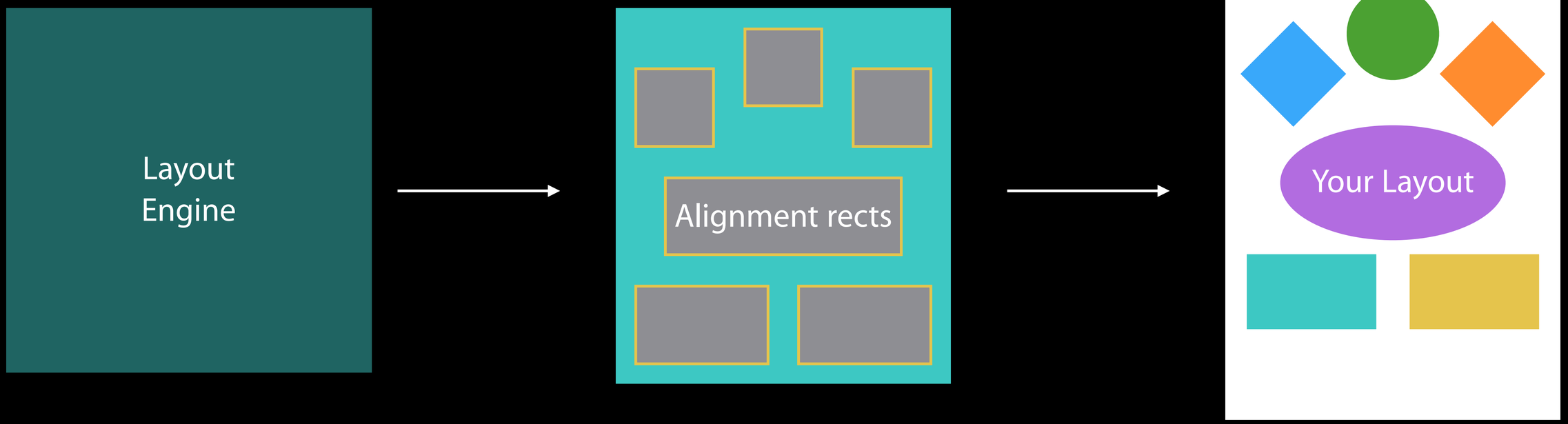

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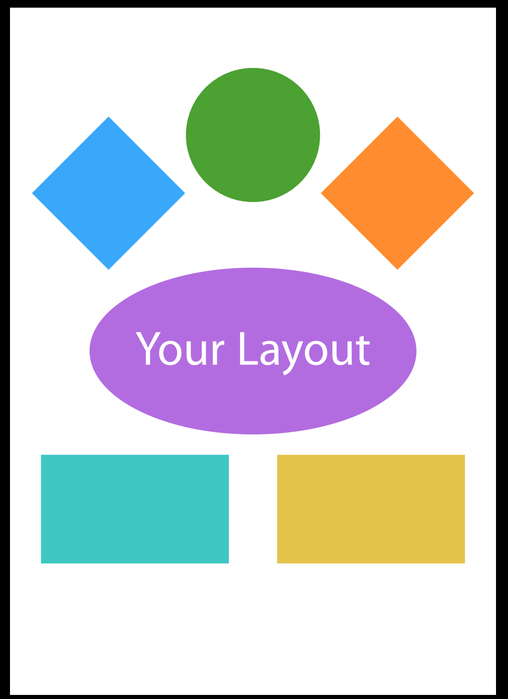

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Use priorities to properly solve your layout

Alignment goes beyond top, bottom, and center

- Keep localization in mind

More Information

Documentation and Videos

Swift Language Documentation

http://developer.apple.com/swift

Sample Code

AstroLayout

http://developer.apple.com/library/prerelease/ios/samplecode/AstroLayout

Technical Support

Apple Developer Forums

http://devforums.apple.com

General Inquiries

Paul Marcos, App Frameworks Evangelist

pmarcos@apple.com

Related Sessions

Mysteries of Auto Layout, Part 2	Presidio	Thursday 1:30PM
What's New in Cocoa	Presidio	Tuesday 1:30PM
What's New in UIKit Dynamics and Visual Effects	Mission	Friday 10:00AM
Cocoa Touch Best Practices	Presidio	Friday 1:30PM
What's New in Internationalization	Pacific Heights	Friday 9:00AM
New UIKit Support for International User Interfaces	Nob Hill	Thursday 2:30PM

Labs

Interface Builder and Auto Layout Lab	Developer Tools Lab C	Thursday 2:30PM

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