Auto Layout

Thinking with Constraints

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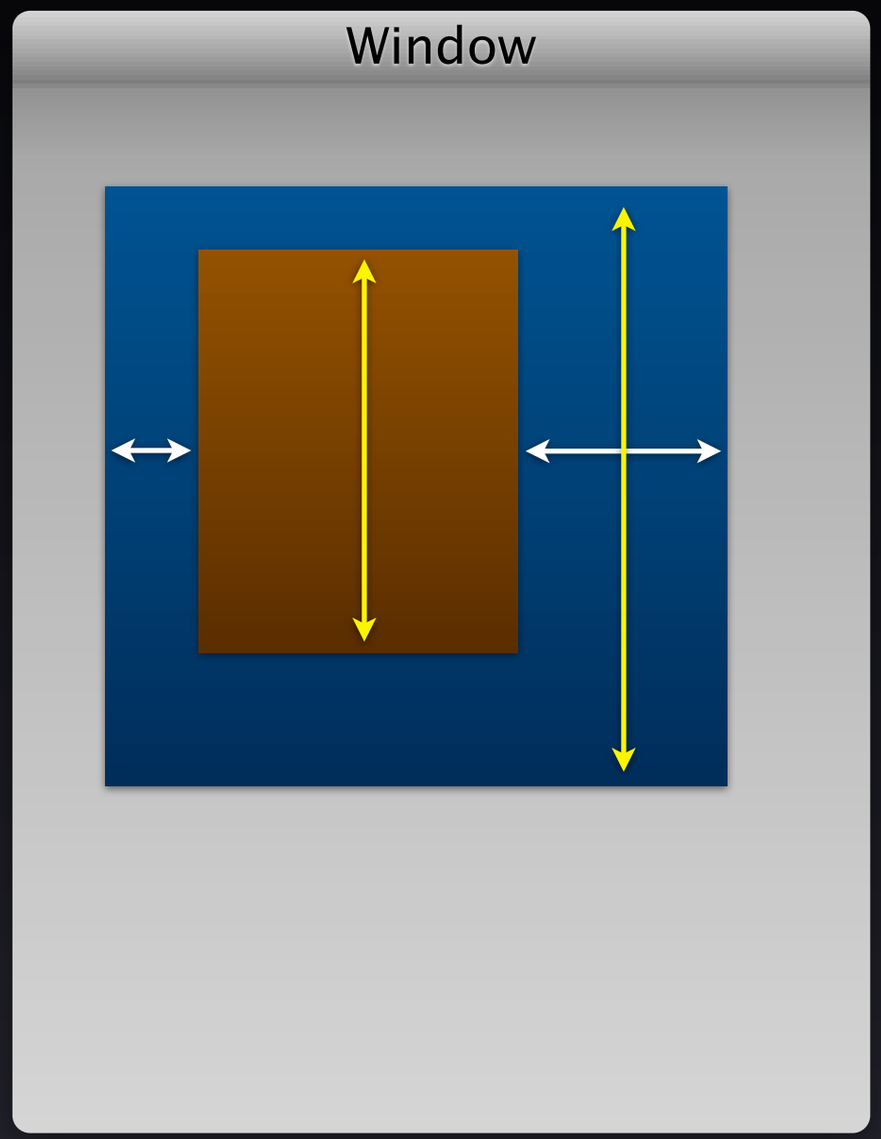
What is Auto Layout?

- Better than springs & struts
- Available in 10.7+ and iOS 6
- Defines views' frames by their contents and relationships to each other
- Dynamically recalculates interface
- Encourages single-pass layout phase over ad-hoc layout

The Old Way: Springs & Struts

- Manually resize views as necessary
- Subviews resize whenever superview resizes
- Autoresizing mask dictates behavior



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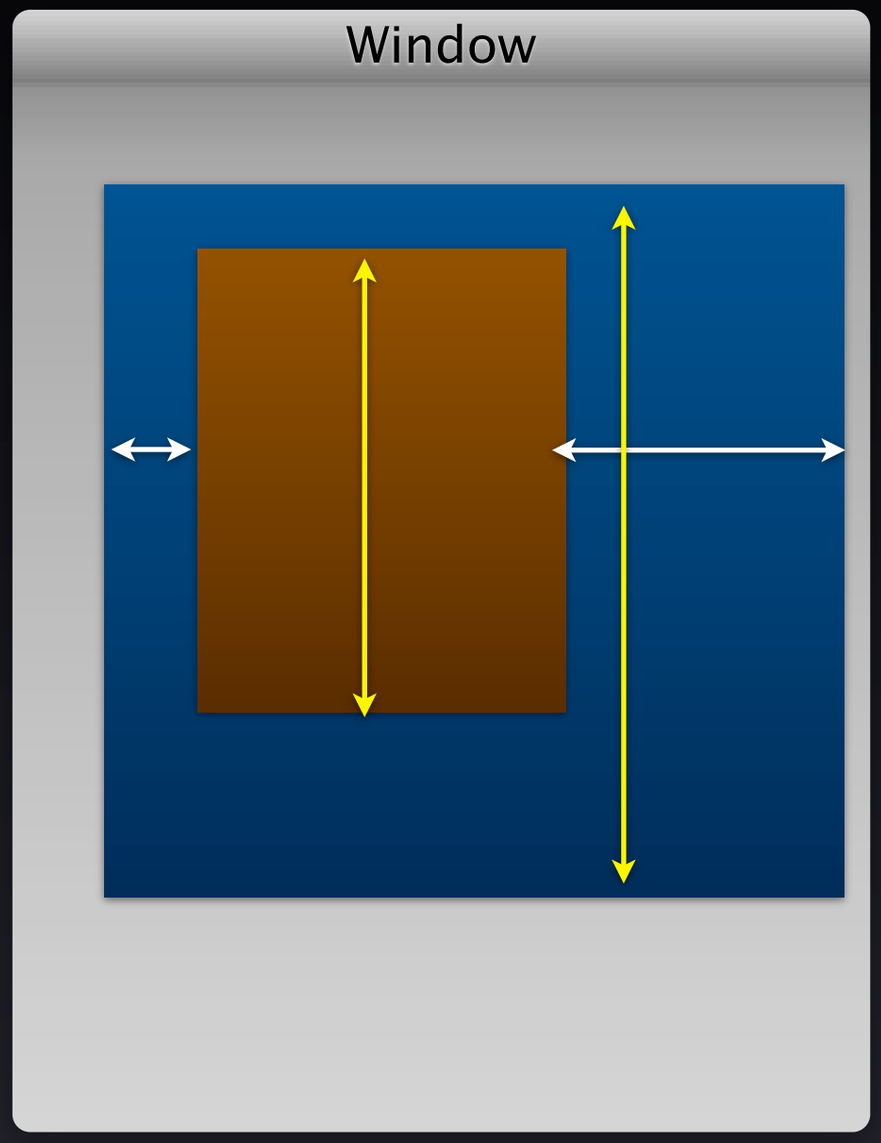
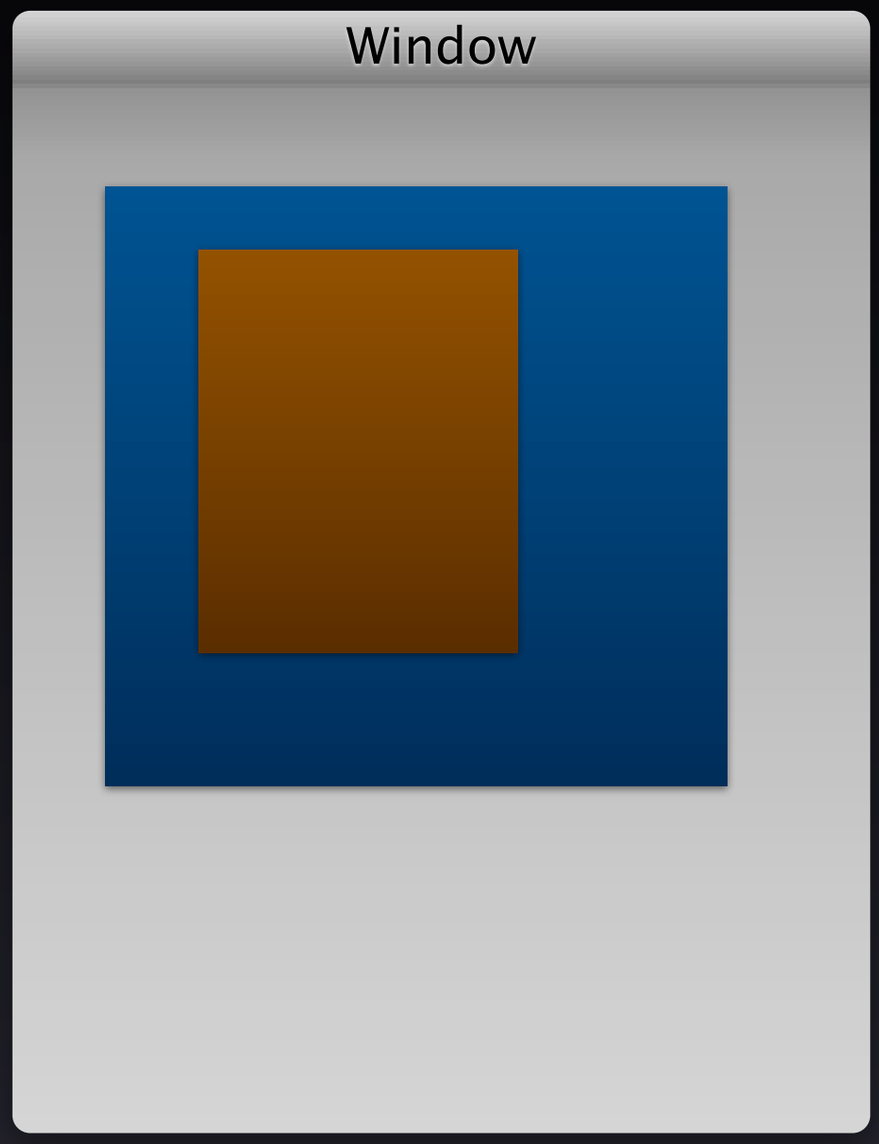


How Auto Layout Works

1) Install constraints on views



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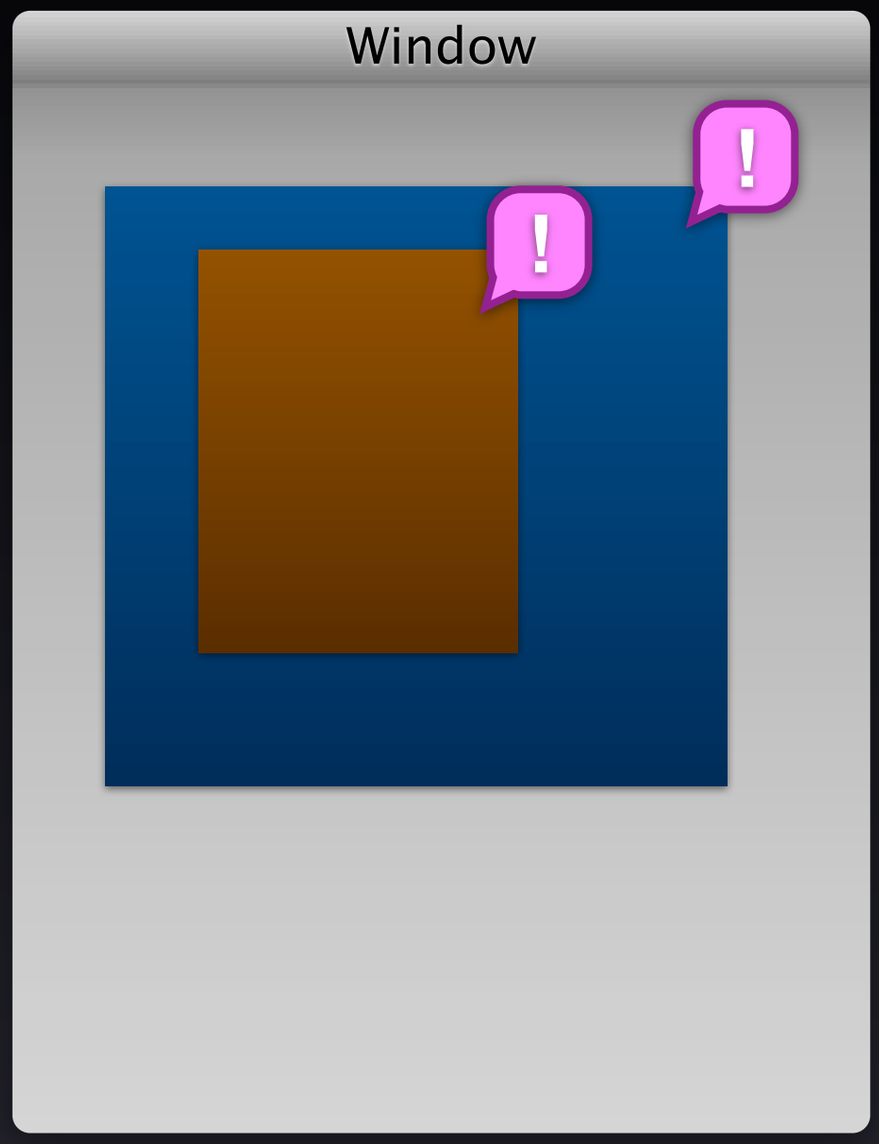

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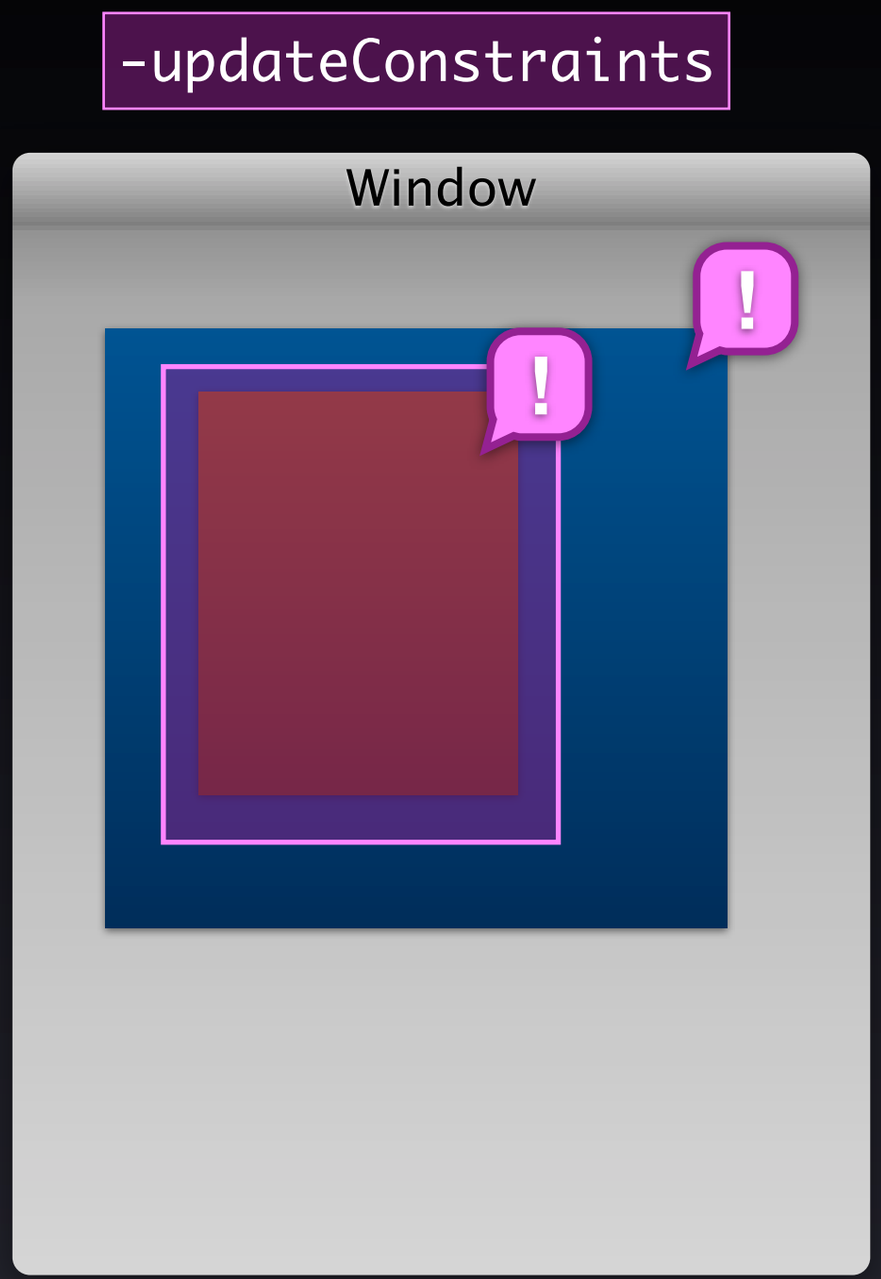

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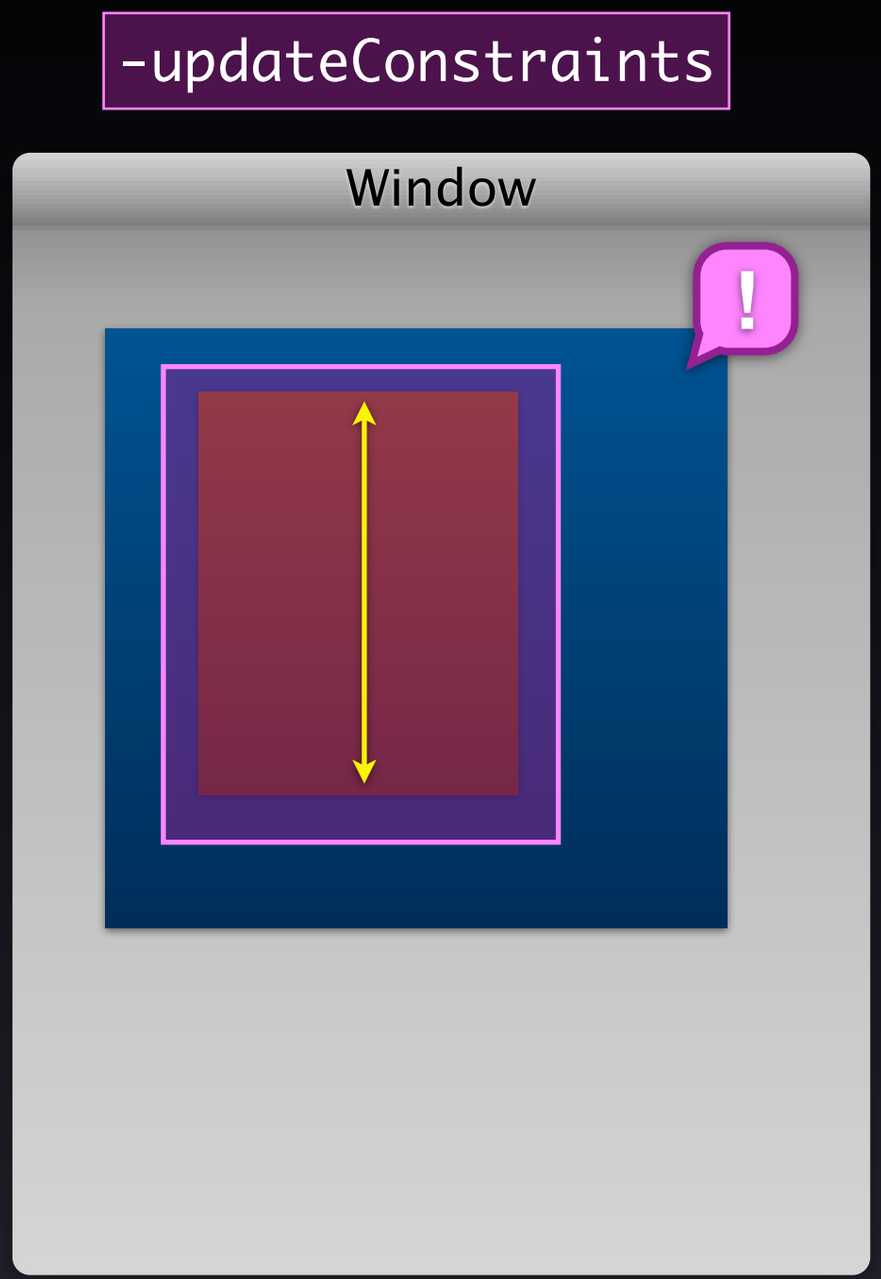

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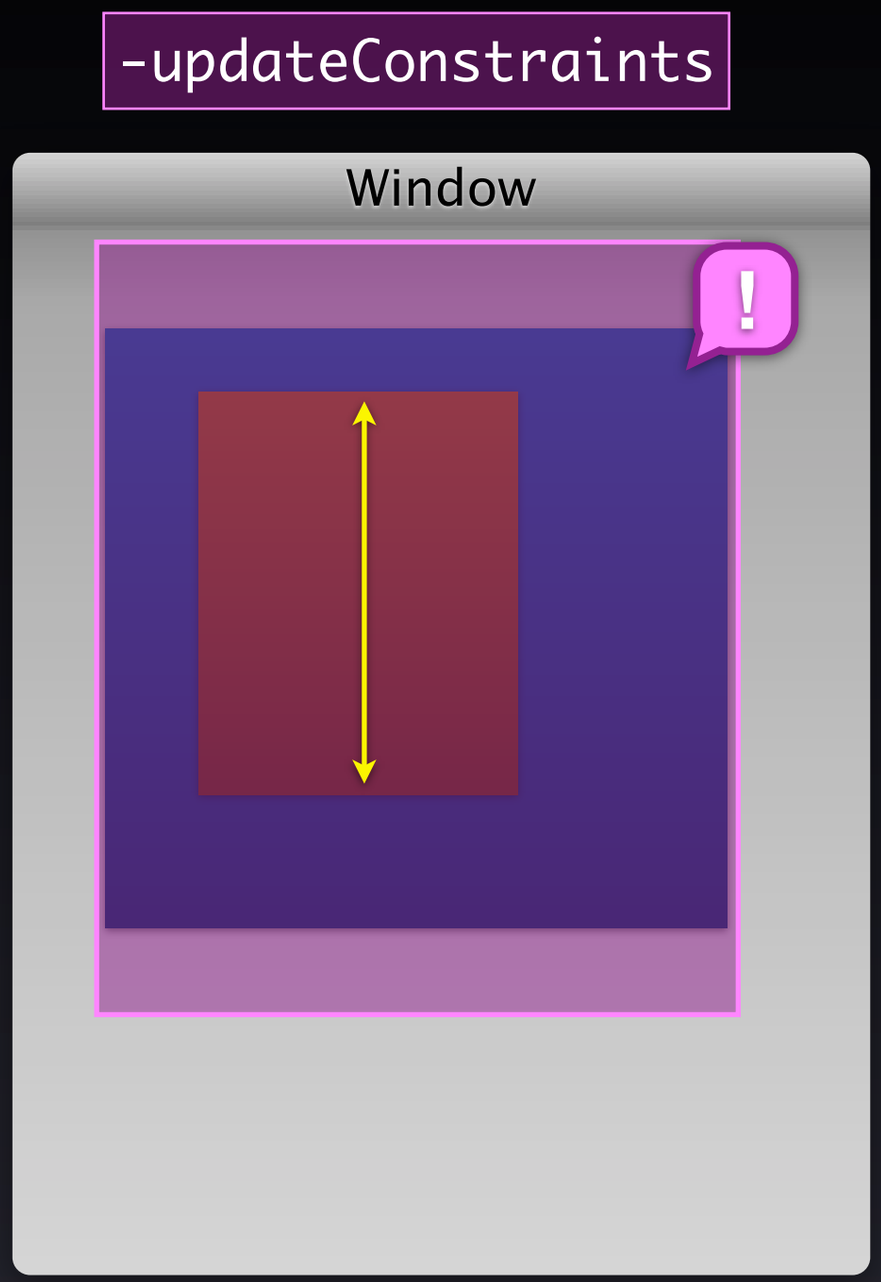

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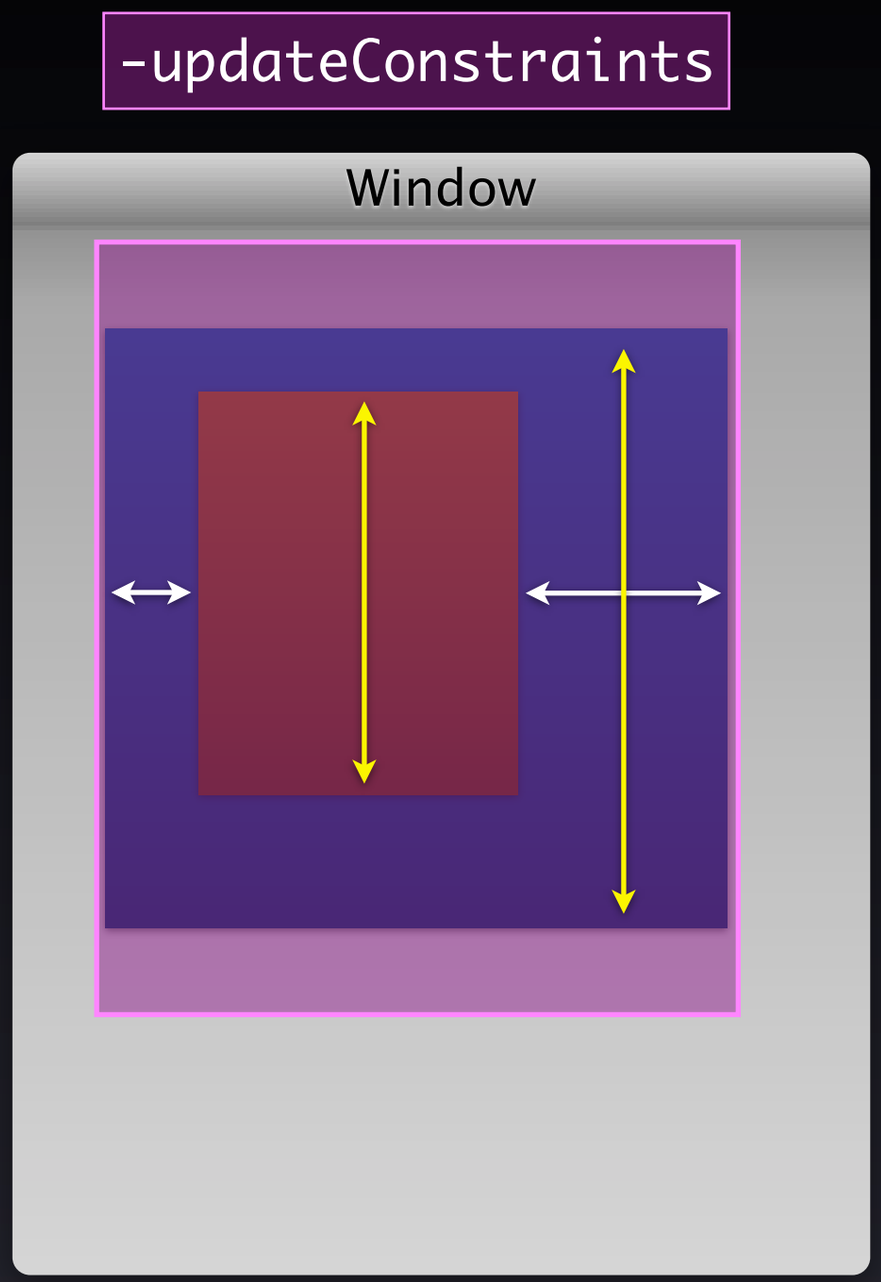

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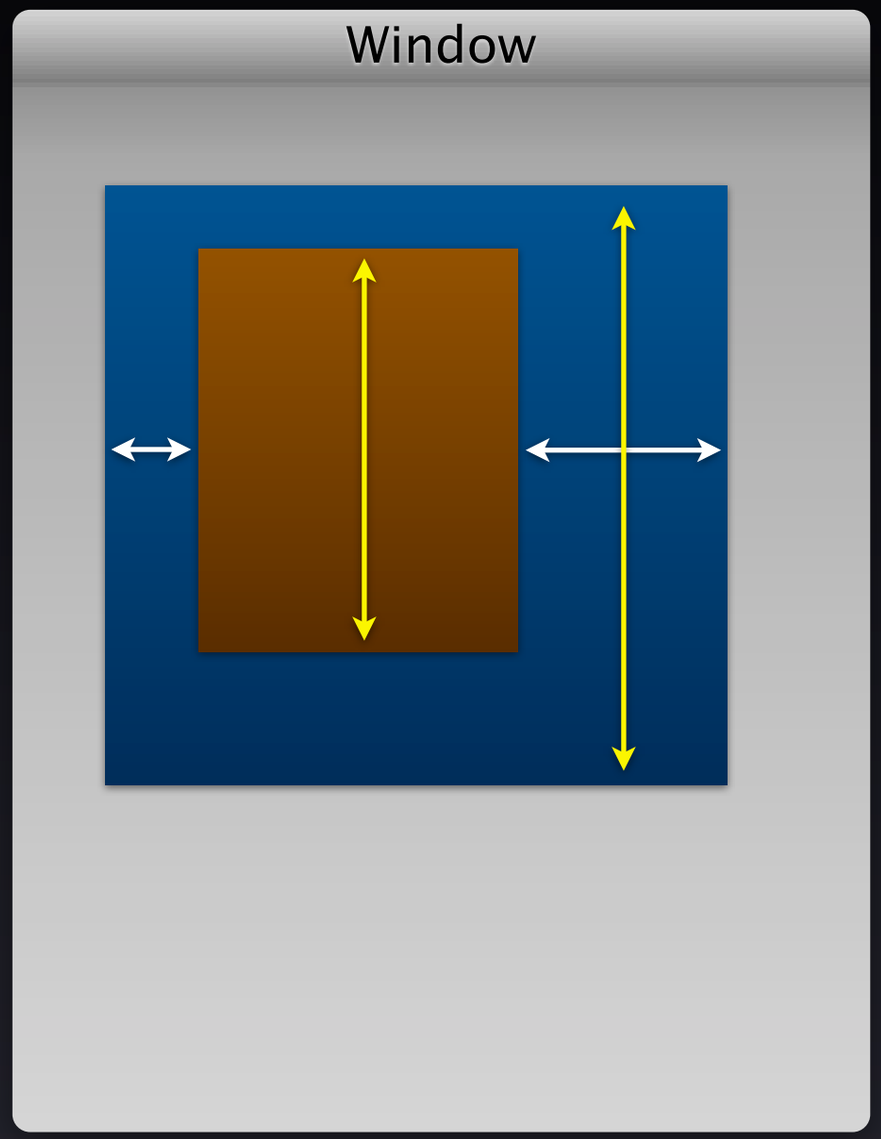
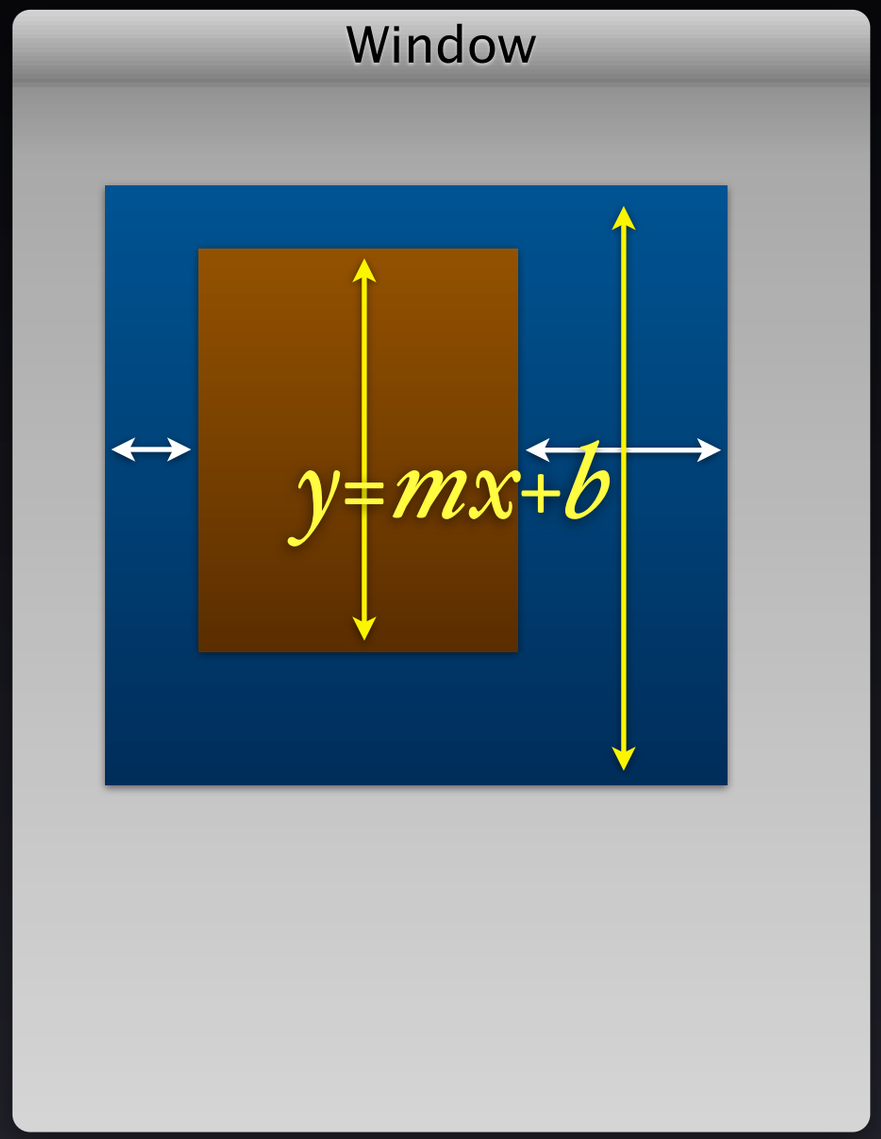


How Auto Layout Works

1) Install constraints on views

2) Constraints are converted into inequalities



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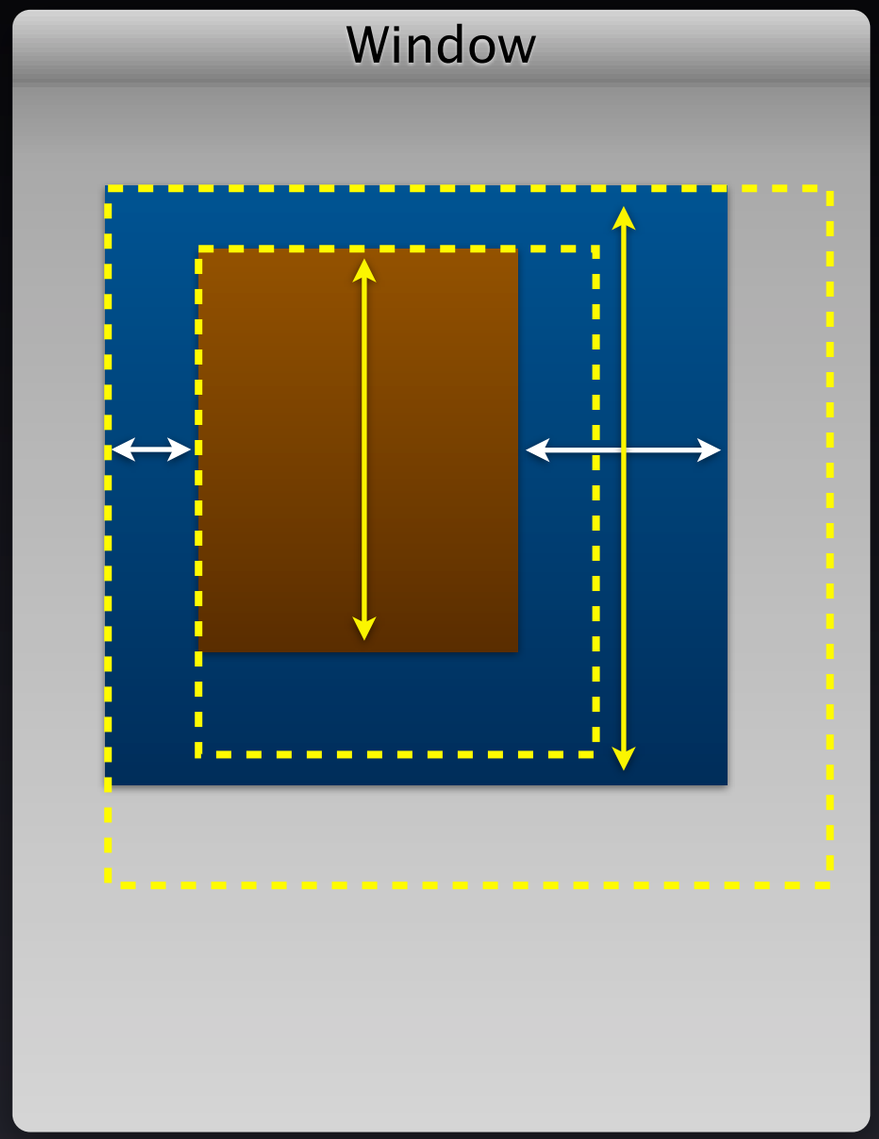
3) System of inequalities is solved all at once



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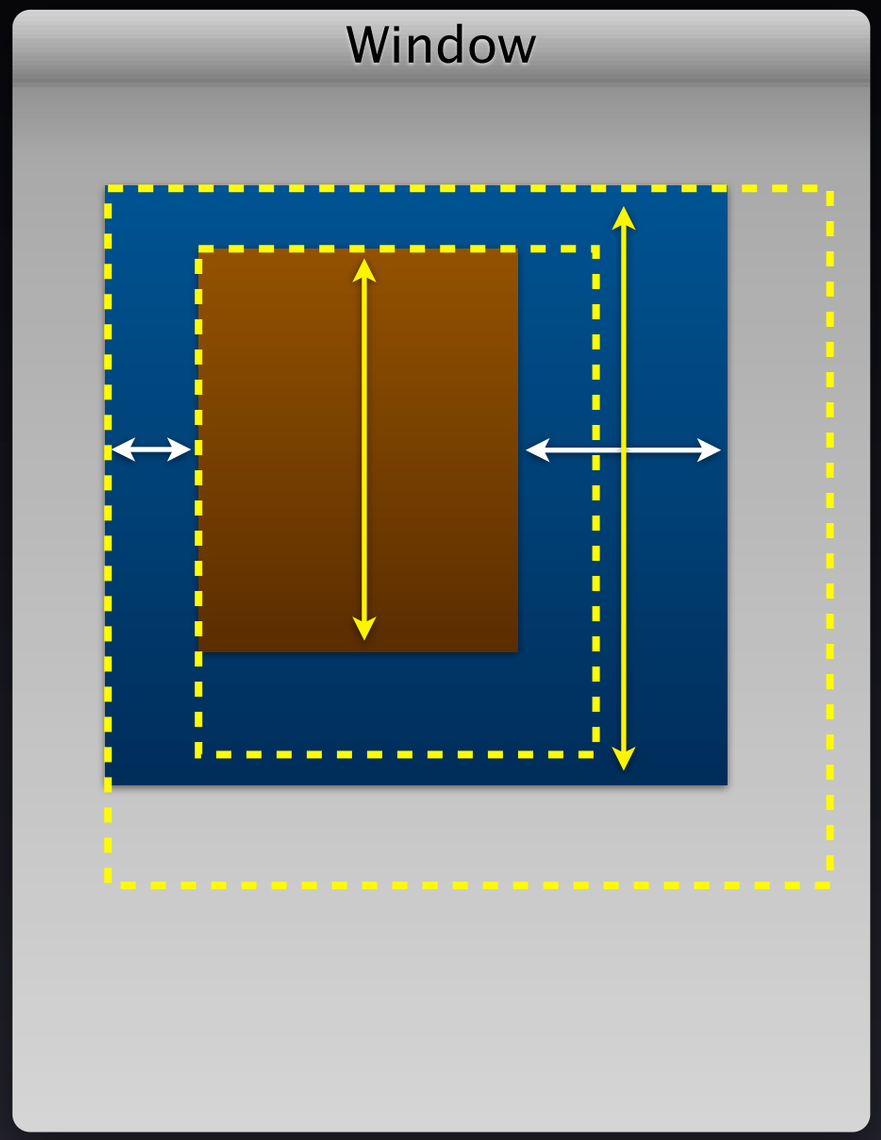

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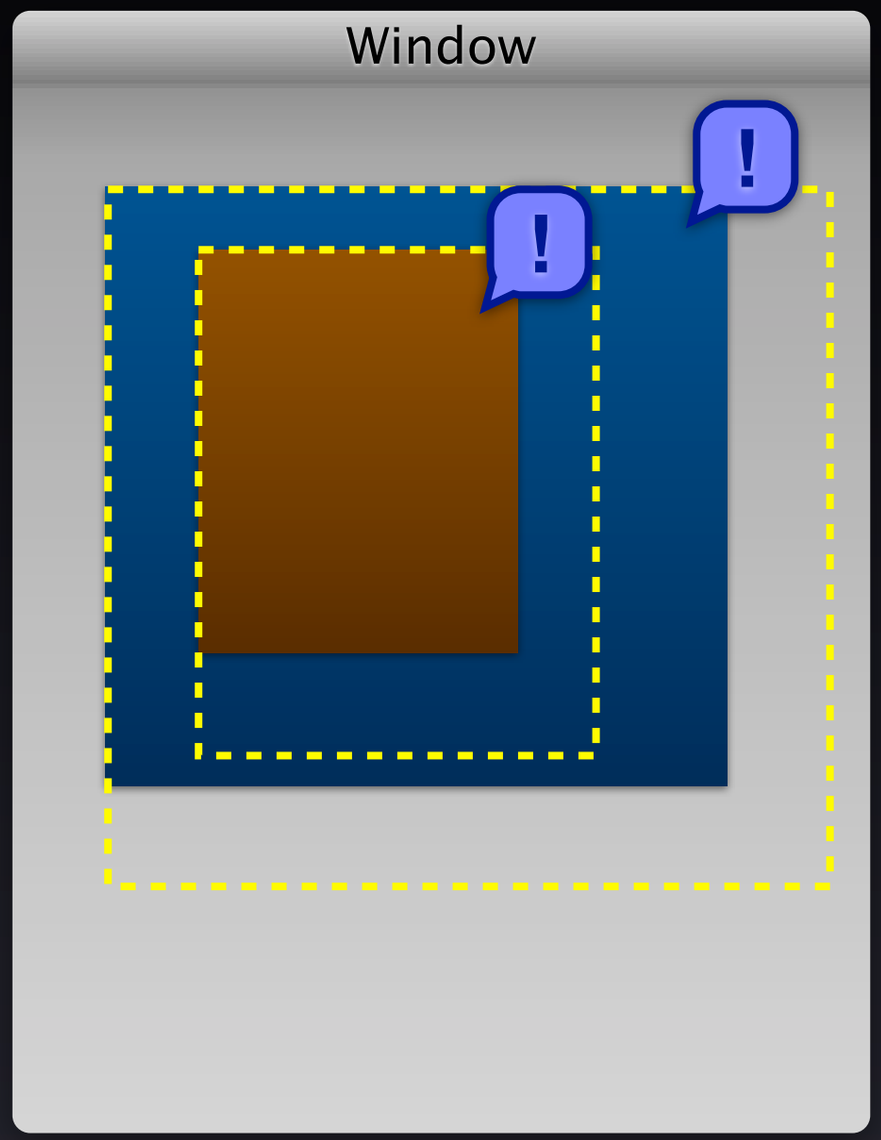

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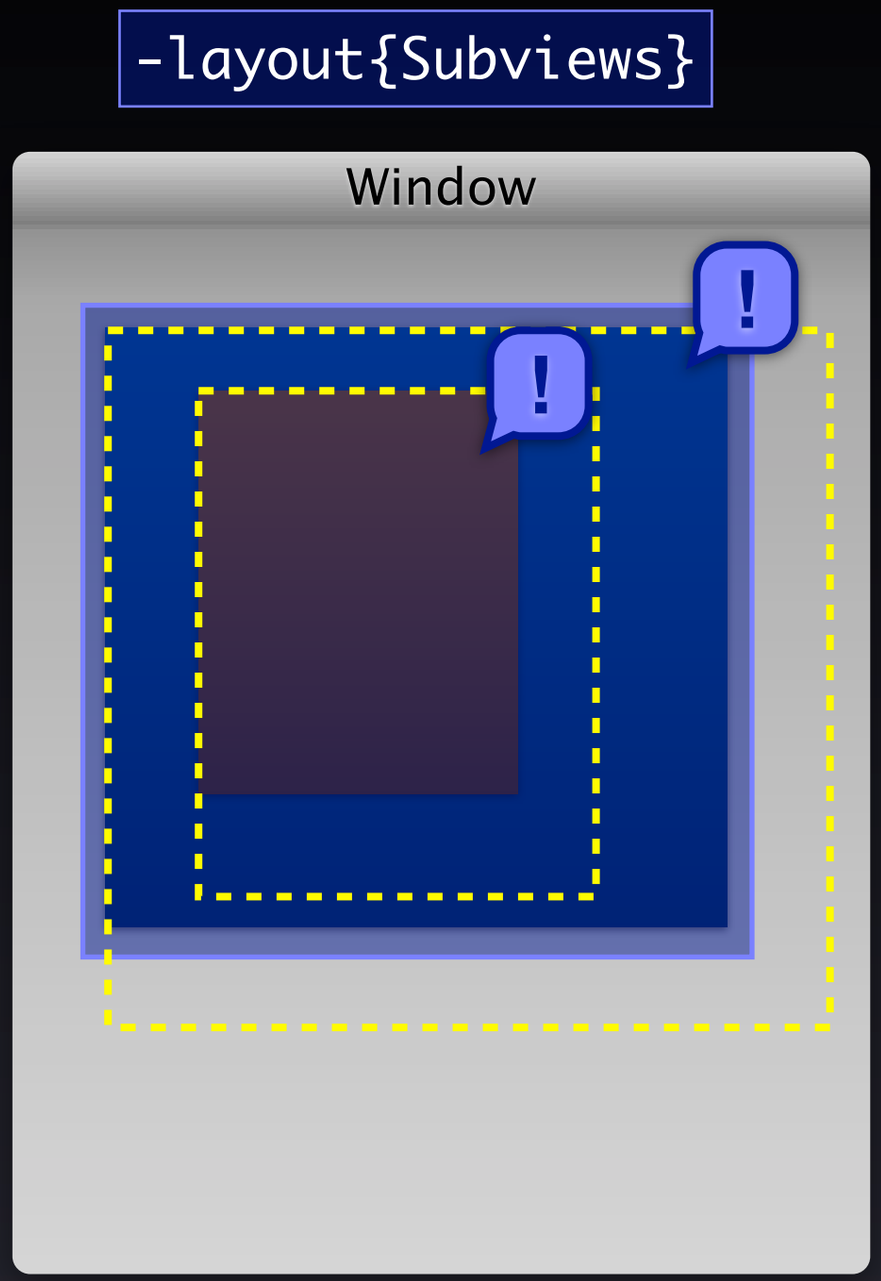

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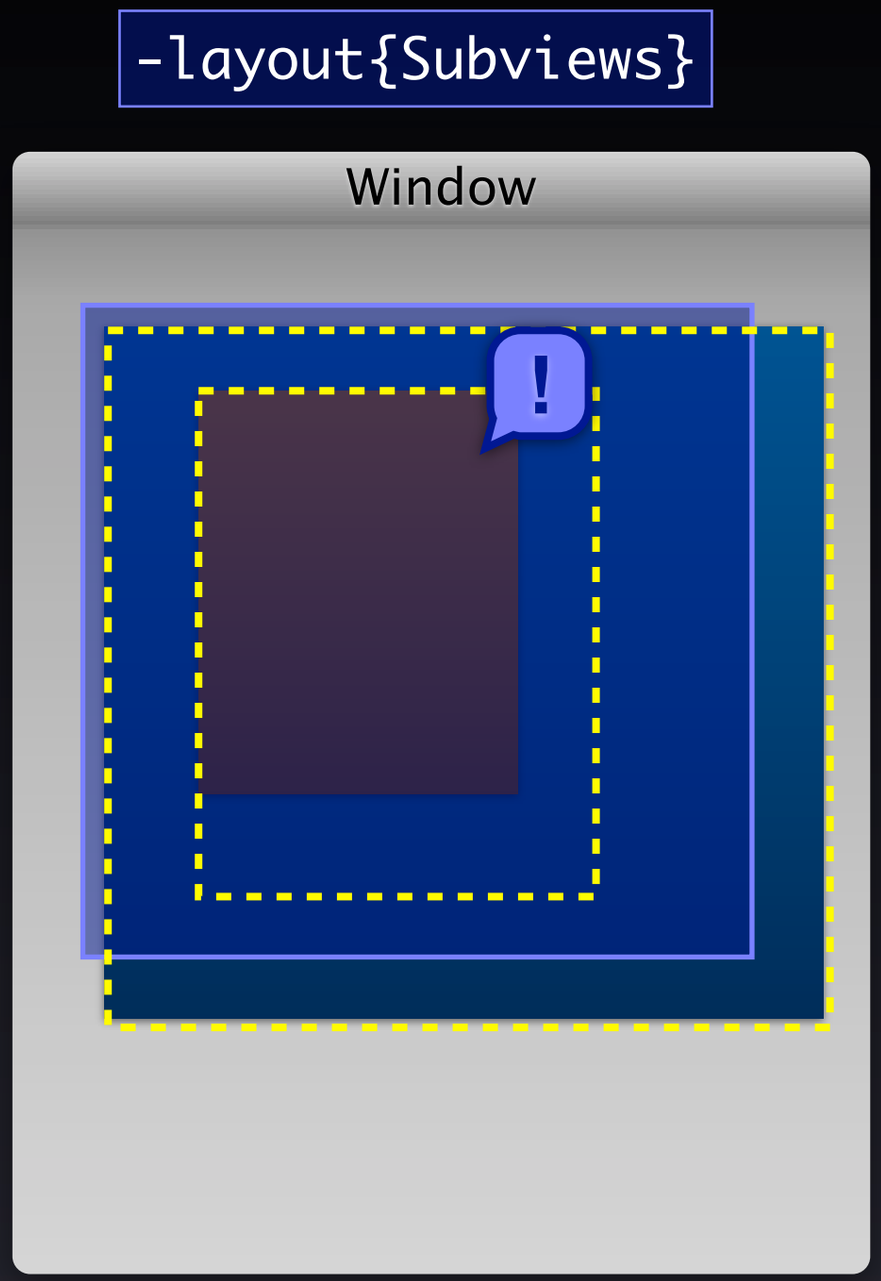

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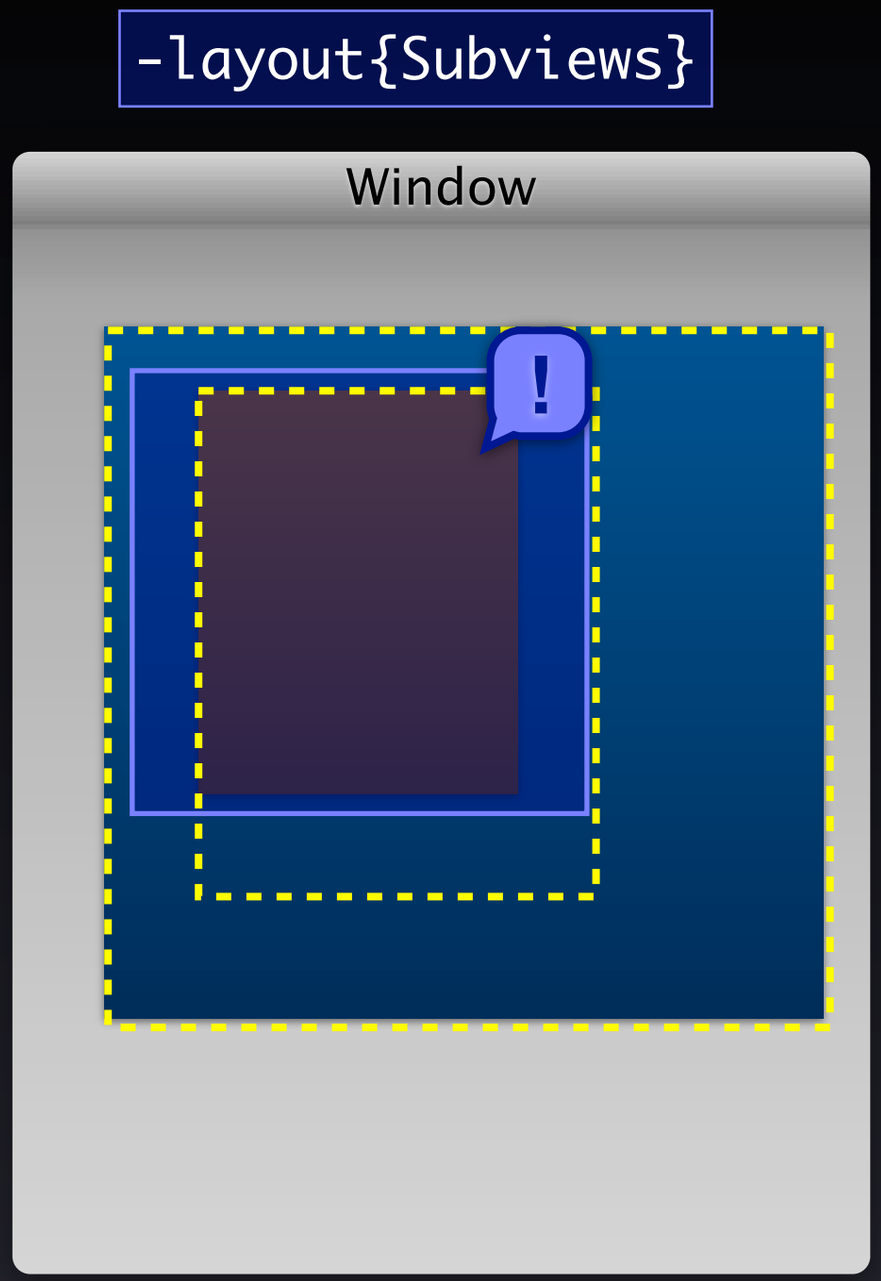

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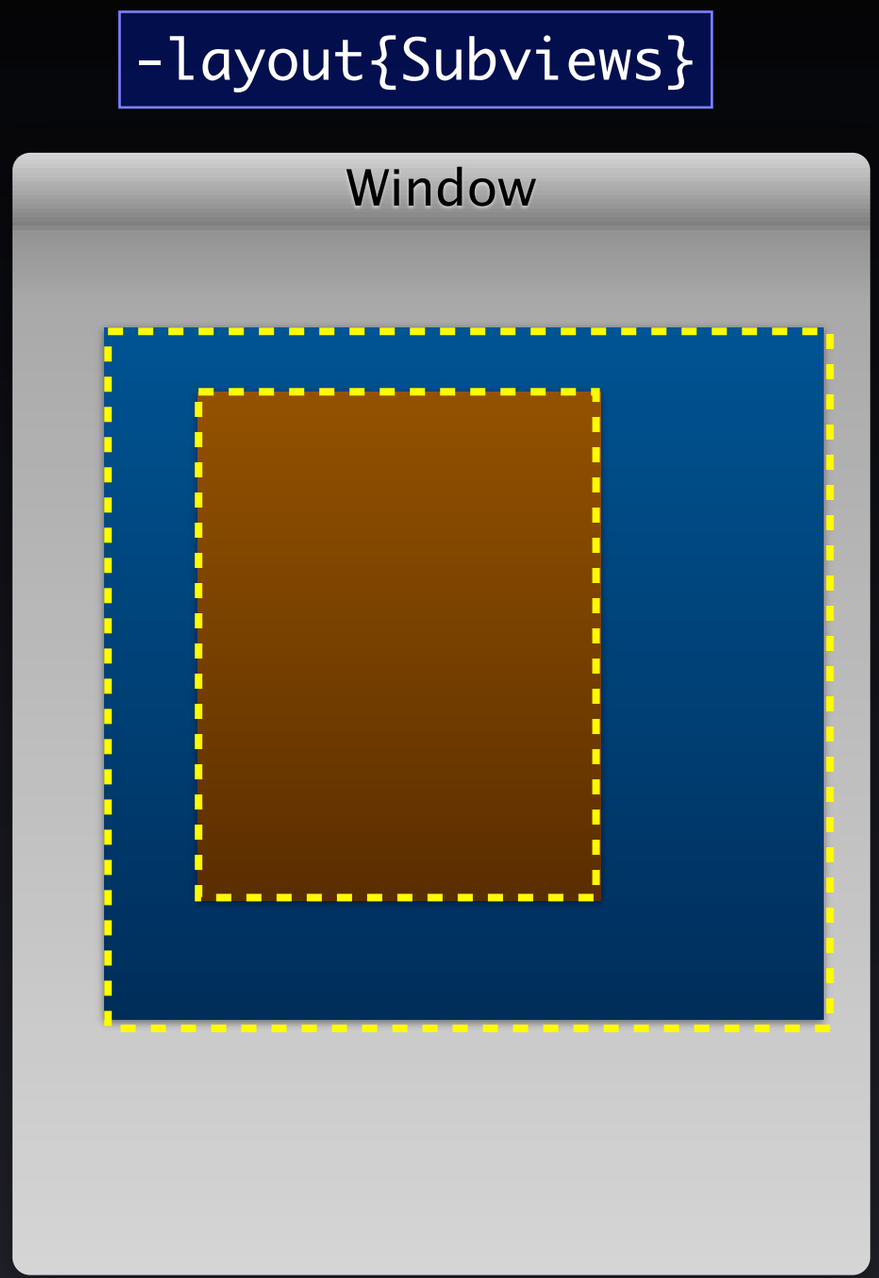

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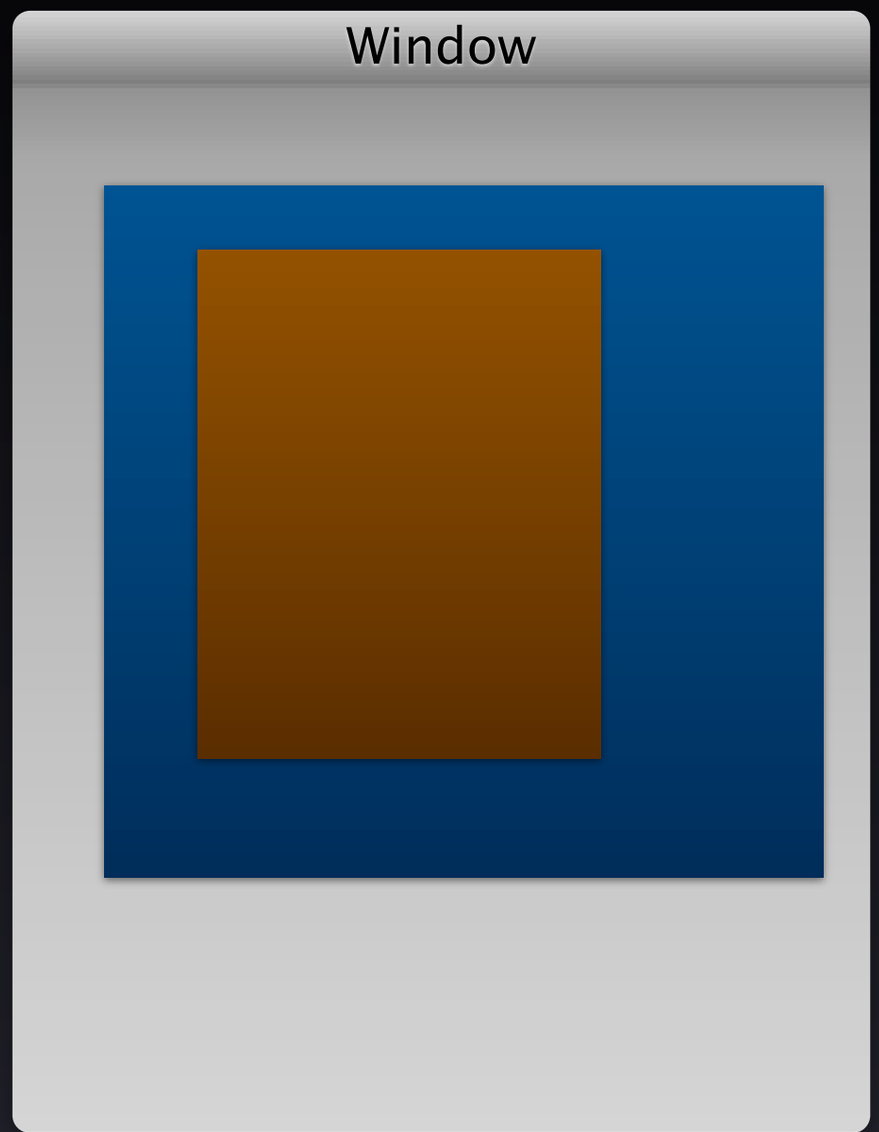
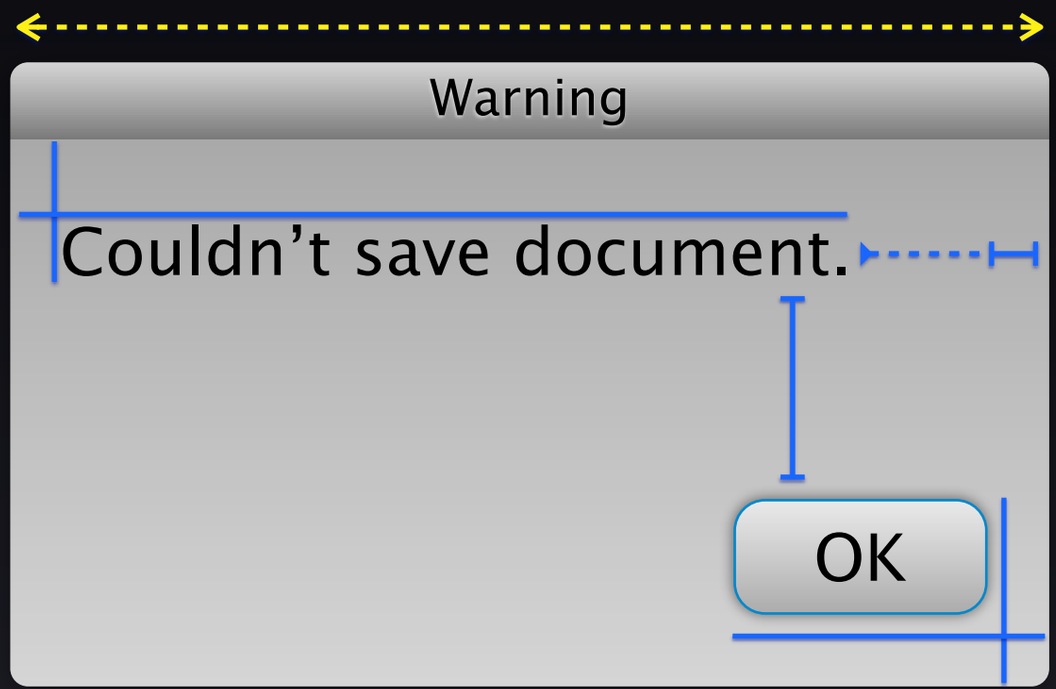


Advantages of Constraints

- Have priorities
- Express inequalities
- Take into account intrinsic sizes
- Have a multiplier and a constant
- Relate to views other than superview

Localization



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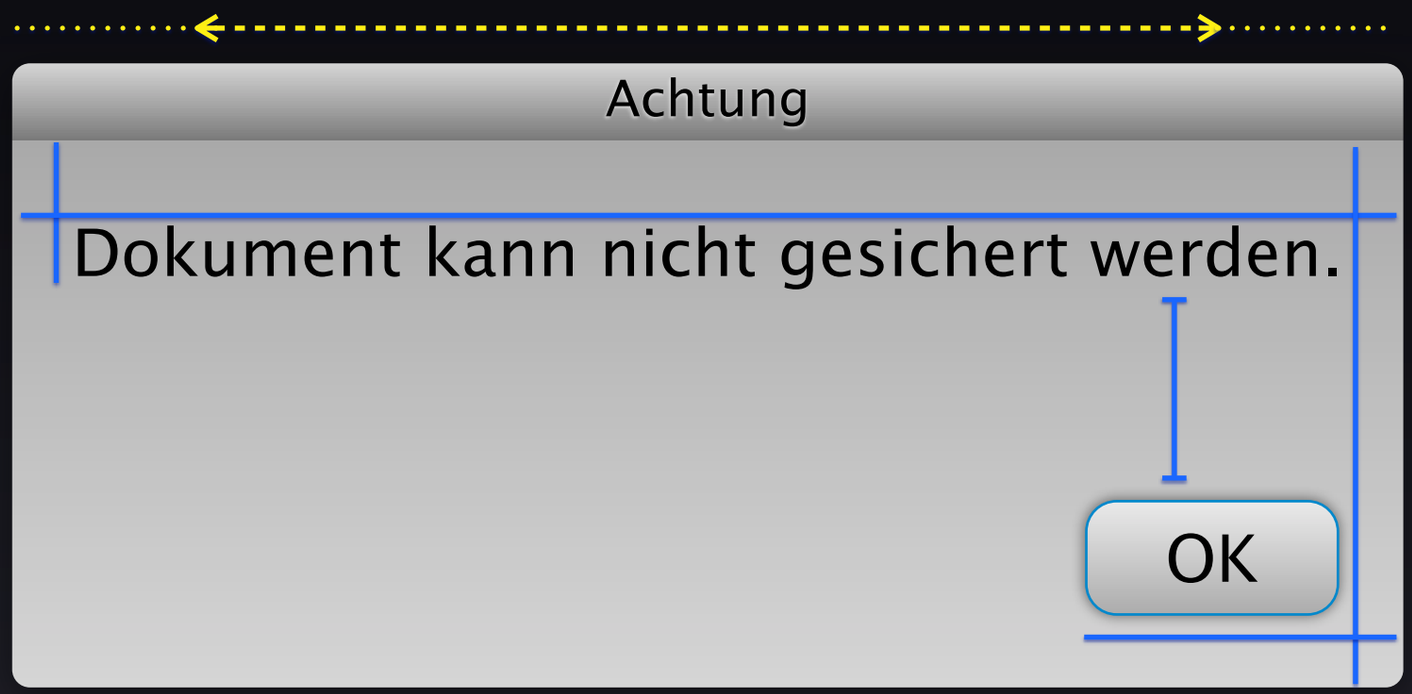


Thinking with Constraints

- Layout is descriptive, not reactive
- Think Globally, Act Locally
- Inequalities have infinite solutions
- Your container needs a size too!

Demo

Auto Layout in Interface Builder

- Turn on auto layout in document inspector
- IB refuses to allow ambiguous layout
  - Would be nice if it did *(r.12986107)*
- "Promote to user constraints" (on Size inspector) to edit and persist constraints
  - It might still delete them if you drag views around!

Auto Layout in Code (OS X)

```
- (void) updateConstraints {
    if (!_myConstraints) {
        _myConstraints = [[NSLayoutConstraint
            constraintsWithVisualFormat:…] retain];
        [self addConstraints:_myConstraints];
    }

    [super updateConstraints];
}
```

Auto Layout in Code (iOS)

```
- (void) updateViewConstraints {
    if (!_myConstraints) {
        _myConstraints = [[NSLayoutConstraint
            constraintsWithVisualFormat:…] retain];
        [self.view addConstraints:_myConstraints];
    }

    [super updateViewConstraints];
}
```

Constraints best practices

- Publish your priority constants
- Wait until `-updateConstraints` to add constraints
- Store constraints in strong ivars
  - Would be nice if constraints had identifiers *(r. 12560969)*

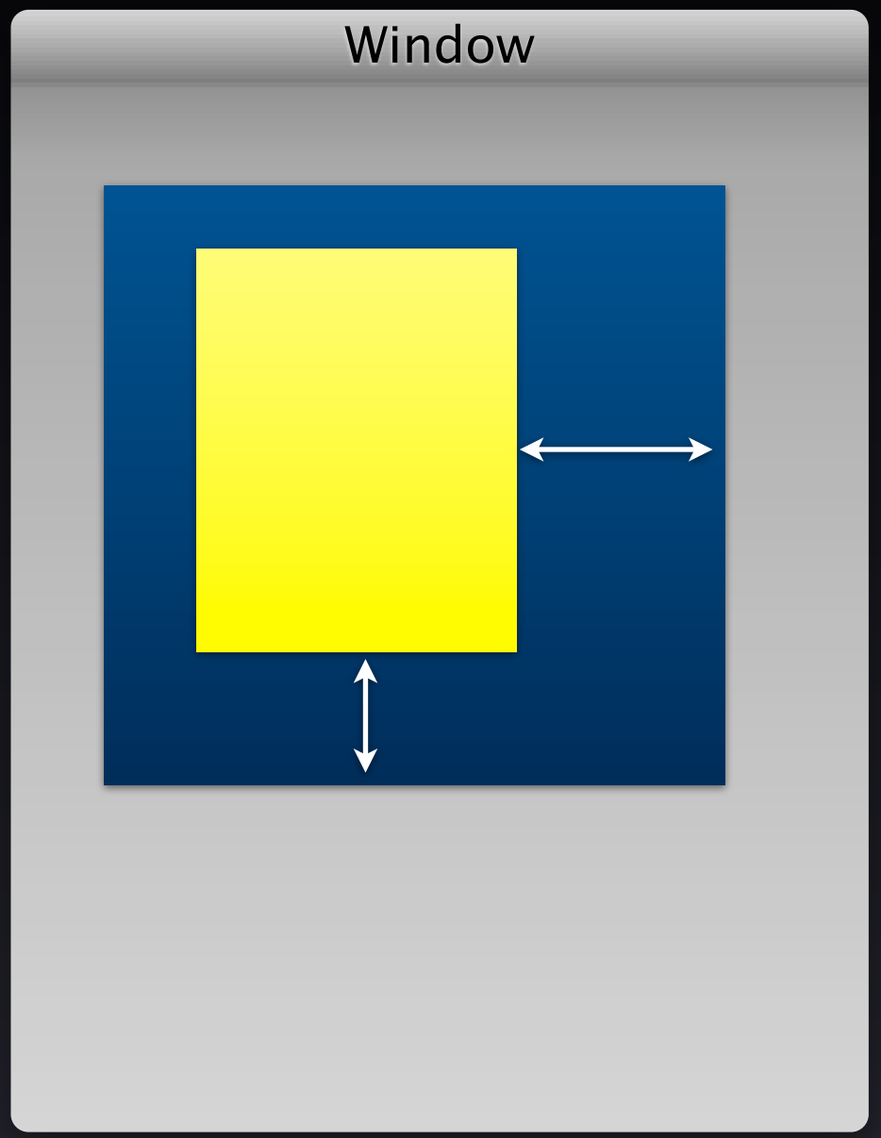
Constraints best practices

- Remove constraints as soon as sensible
- Don’t remove constraints unnecessarily
  - Updating is faster than removing
  - Easy to cause ambiguity
  - Other views might add constraints
  - This means do not do `[self removeConstraints:self.constraints]`

What about existing code?

- `translatesAutoresizingMaskInto-Constraints`
- Managed by the *superview* (or view controller)
- Produces constraints that express your view's frame

translatesAutoresizingMask-IntoConstraints



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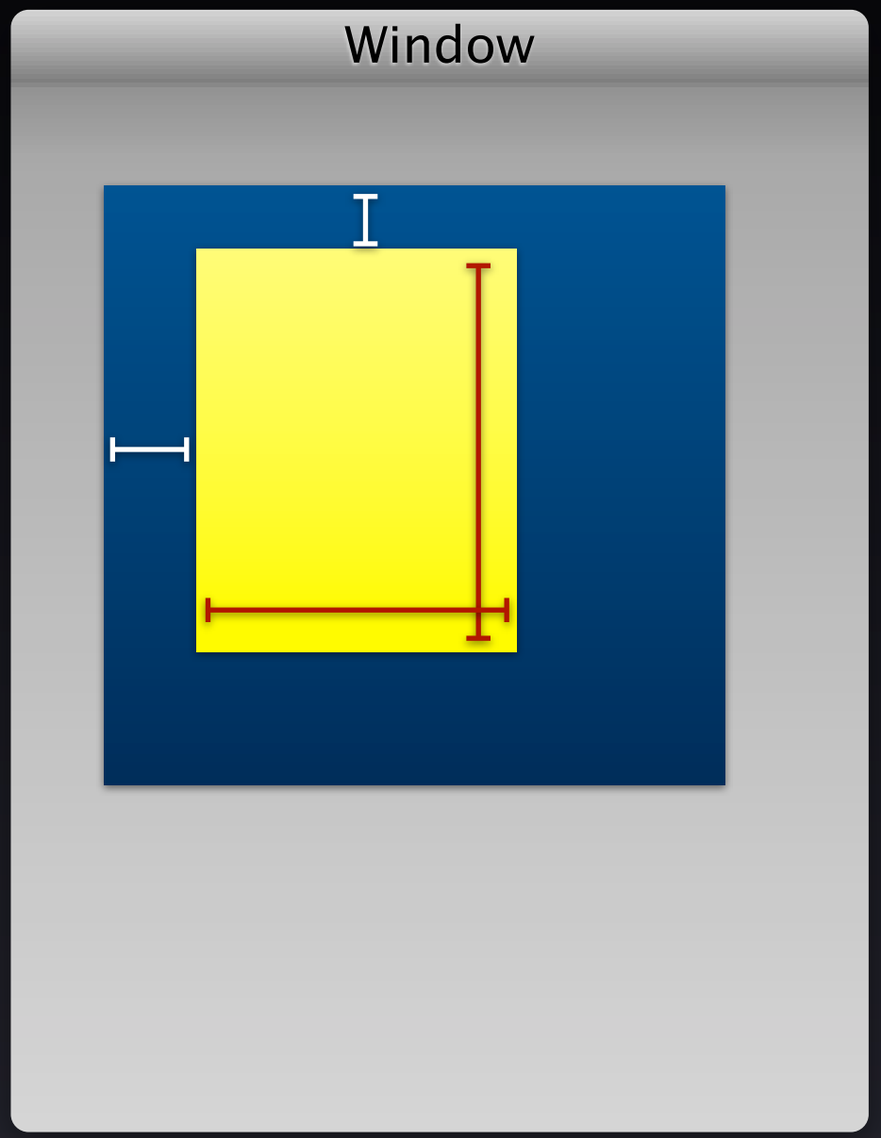


It Just Works™

- If nobody opts into auto layout, it is never enabled for the window
- `-resizeSubviewsWithOldSize` is sent as usual
  - This method is aware of constraints
  - Runs the solver without invoking `-updateConstraints` *(r.12466034)*

It Just Works™

- Translated constraints are installed on the superview (not guaranteed, but logical)
- Not guaranteed when constraints will be updated or installed
  - Installation seems to wait for in `-updateConstraints`
  - Updates seem to happen immediately in `-setFrame:`

Scroll Views

Scroll Views (iOS)

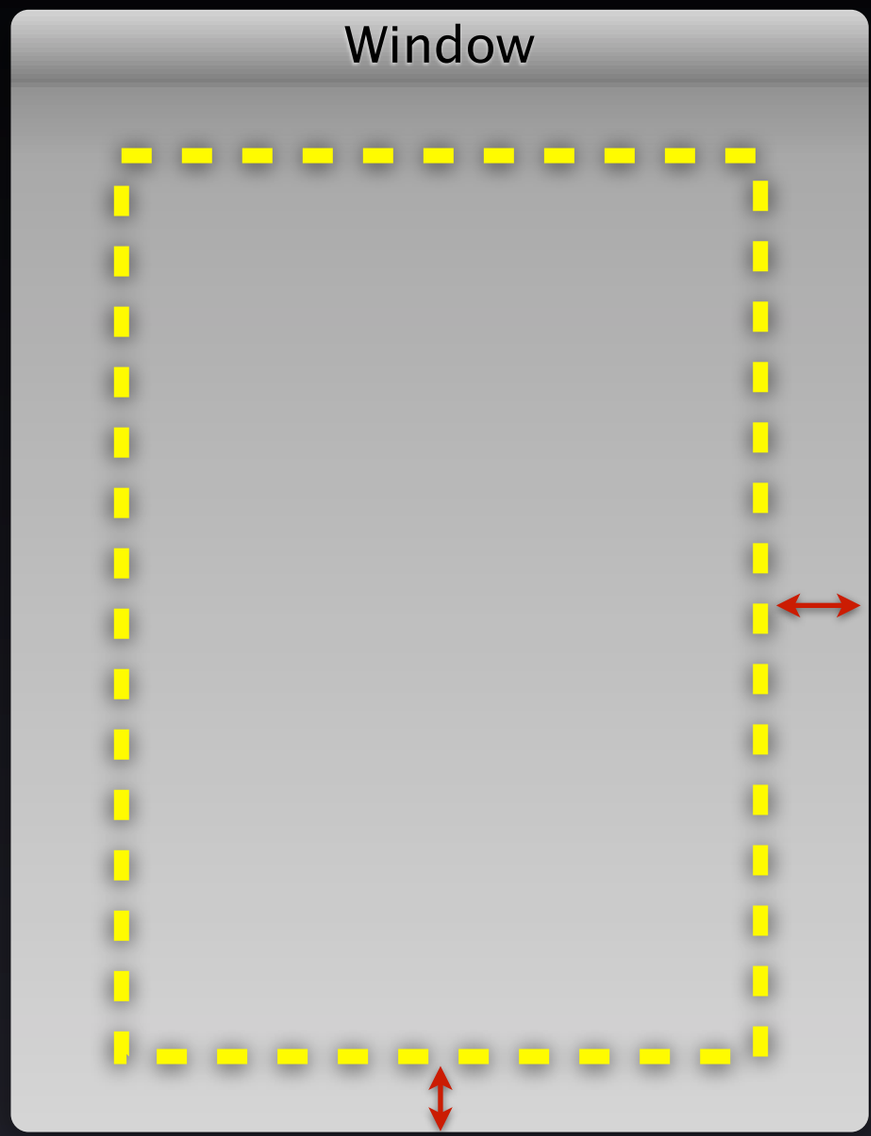
- UIScrollView treats constraints specially
  - Its subview's constraints determine the scroll view's `contentSize`
  - **Do not set the `contentSize` property!**
  - Ensure that constraints *external* to the scroll view sufficiently define its frame
- IB support is a bit confusing at first

Demo

Scroll Views (OS X)

- NSScrollView contains an NSClipView
- Positions this view in `-tile` using `-setFrame:`
- NSClipView transforms its bounds origin
- Naive attempts to fill the scroll view's viewport will resize the scroll view

Scroll Views (OS X)



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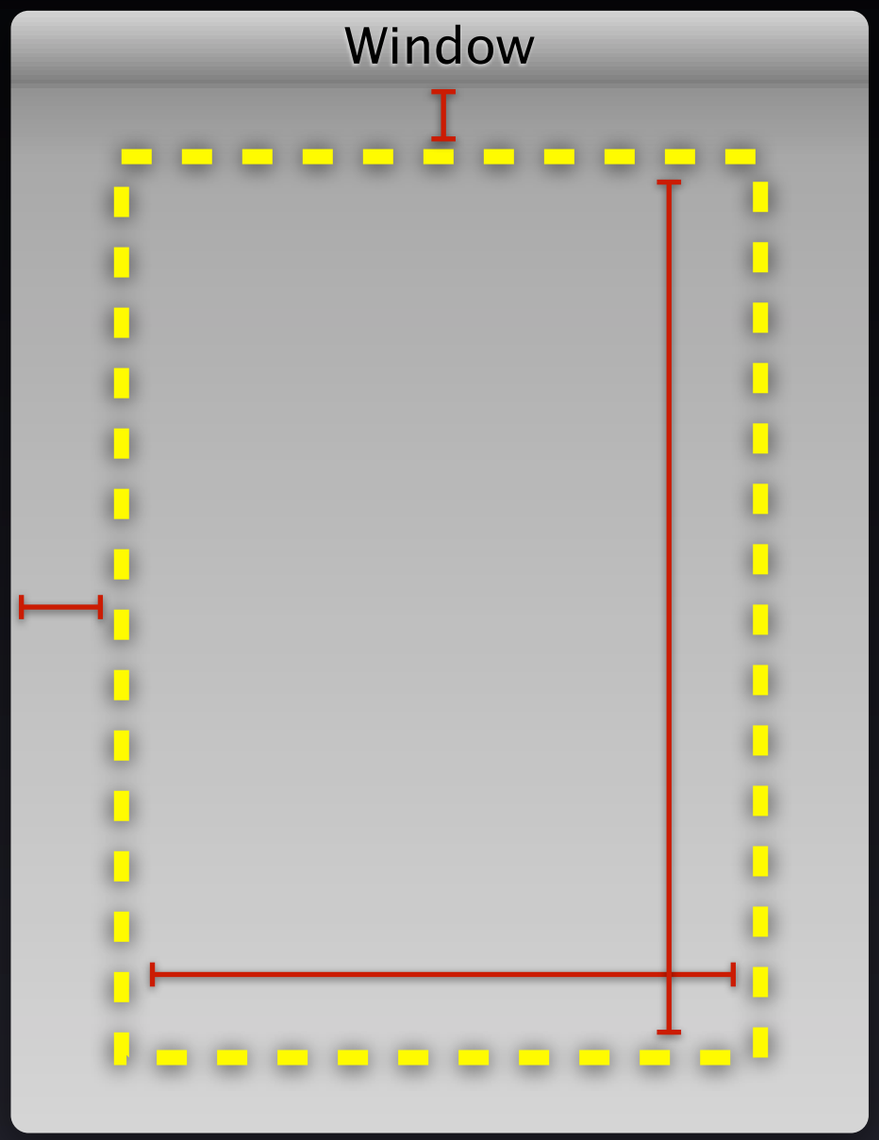

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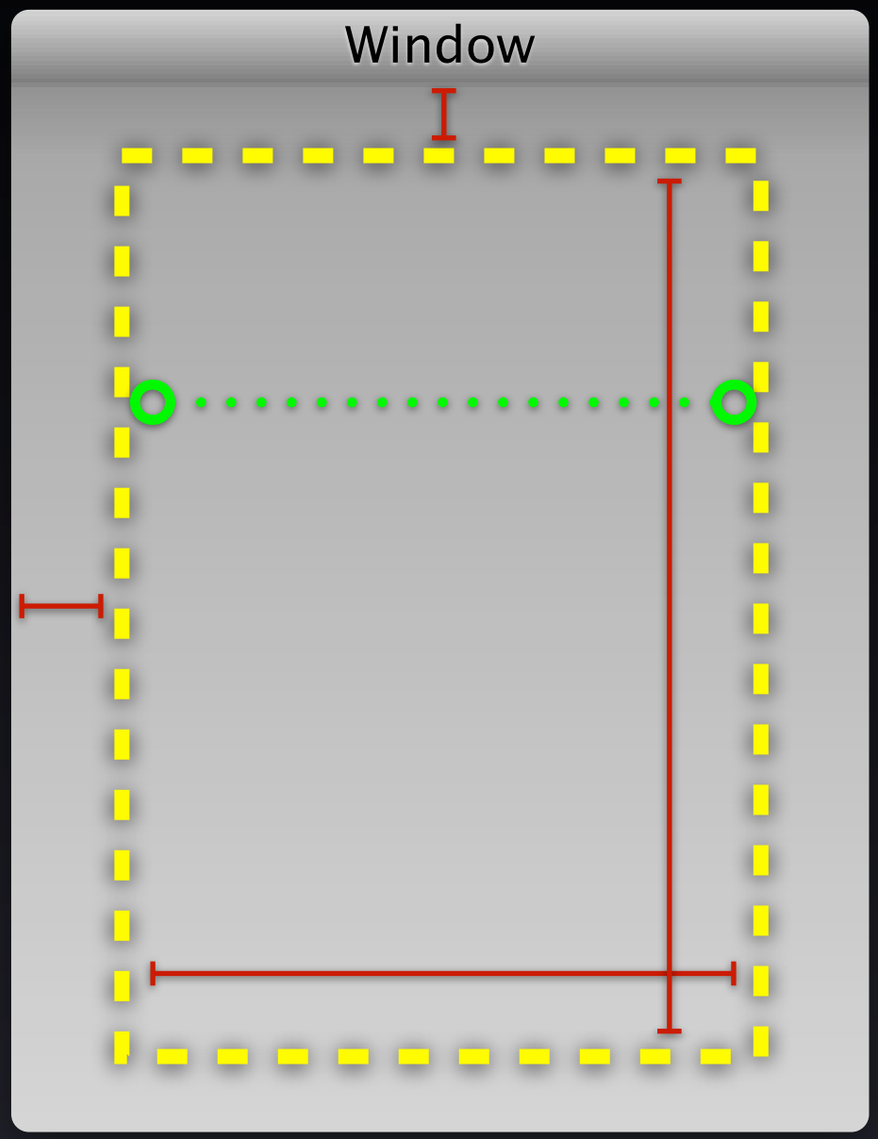

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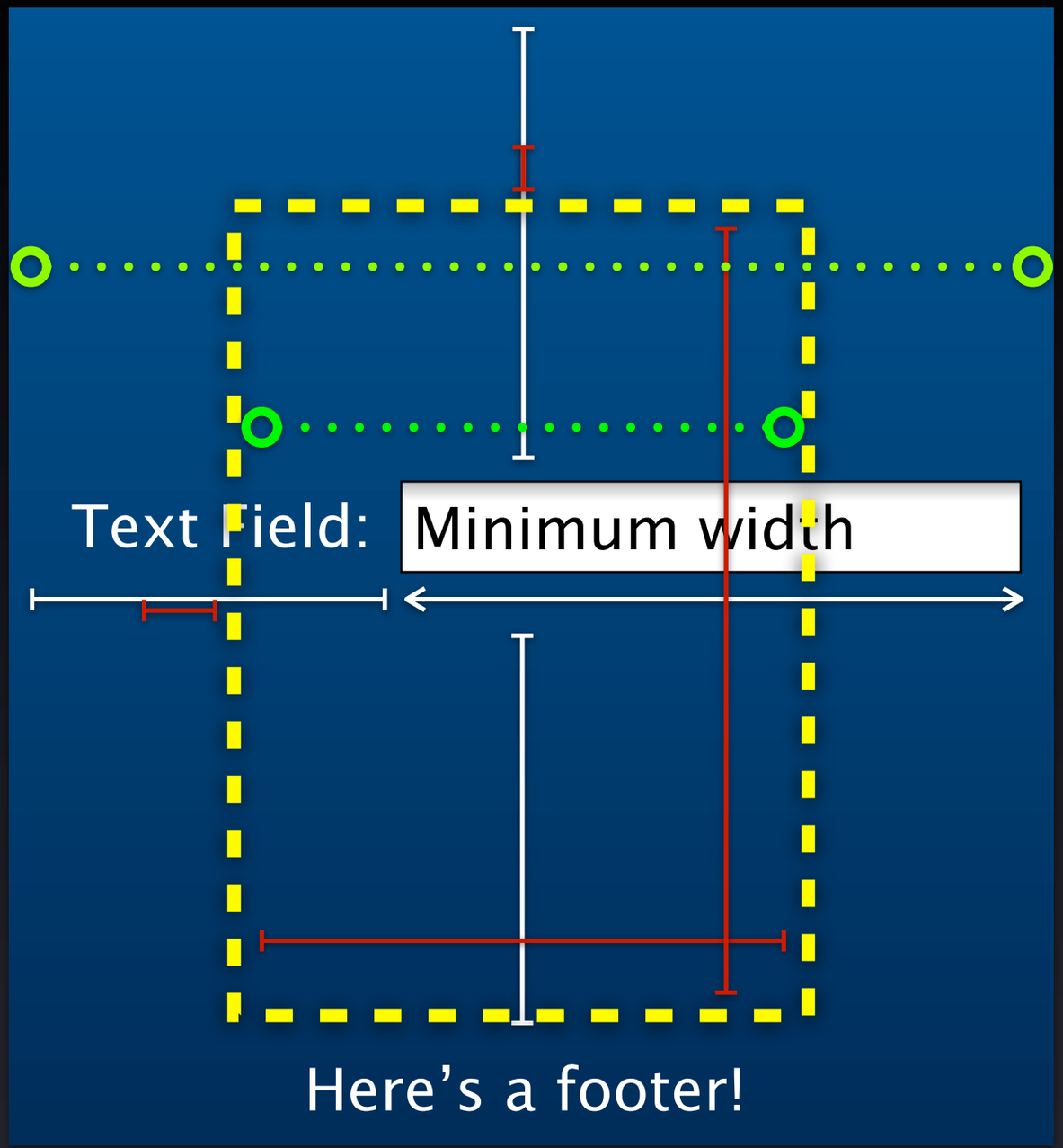

Scroll Views (OS X)

- Solution: install constraints on self to fill available viewport space
- Break our superview's use of `translatesAutoresizingMaskInto-Constraints` by forcing it to `NO`
- This is a **HACK!** Don't do this lightly!

Views that don’t support Auto Layout

- NSSplitView (10.7)
- UICollectionView
- Views that want to fill their scroll view frame
  - NSTableView, NSTextView
  - Can sometimes fake it by overriding `-intrinsicContentSize`

Beyond form fields

- Most interesting interfaces aren’t forms
- Sometimes auto layout can’t express *all* of what we want, but can express *most* of it
- Single-pass layout is beneficial on its own
- Override `-layout`

Rules of custom layout

- Cannot leave `-layout` needing layout
- Cannot leave `-updateConstraints` needing constraints updated
- Call `super` from overrides of both
- Earlier passes should not invoke later ones
- Views' positions must be fully specified

Demo

Debugging

- -[NSWindow visualizeConstraints:]
- -[{NS,UI}View constraintsAffecting LayoutFor{Orientation,Axis}:]
- -[NSView _subtreeDescription]
- -[UIView _autoLayoutTrace]

Summary

- Constraints are more powerful than springs & struts
- Your existing springs & struts code should work with `translatesAutoresizingMaskIntoConstraints`

Summary

- When using auto layout with UIScrollView, don’t try to set its contentSize
- When using it with NSScrollView, you have to hack around to fill your superview frame
- There are some classes that don’t support constraints at all

Other Resources

- WWDC 2012 videos
  - Session 202: Introduction to Auto Layout
  - Session 232: Auto Layout by Example
  - Session 228: Best Practices for Mastering Auto Layout

Other Resources

- Radars
  - 12986107 (IB should allow ambiguous layout at design time)
  - 12560969 (Constraints should have an identifier property)
  - 12466034 (`-resizeWithOldSuperview-Size:` should invoke `-updateConstraints`)

Q&A

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Thank You