Introducing Collection Views

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code github.com/mpospese/IntroducingCollectionViews

slides bit.ly/ViTNiK

Who Am I?

- Studied mathematics, marine biology, and teaching English as a Second Language
- 14 years industry experience
- Programming for mobile since 1999!
- Mobile Architect for Y Media Labs

Outline

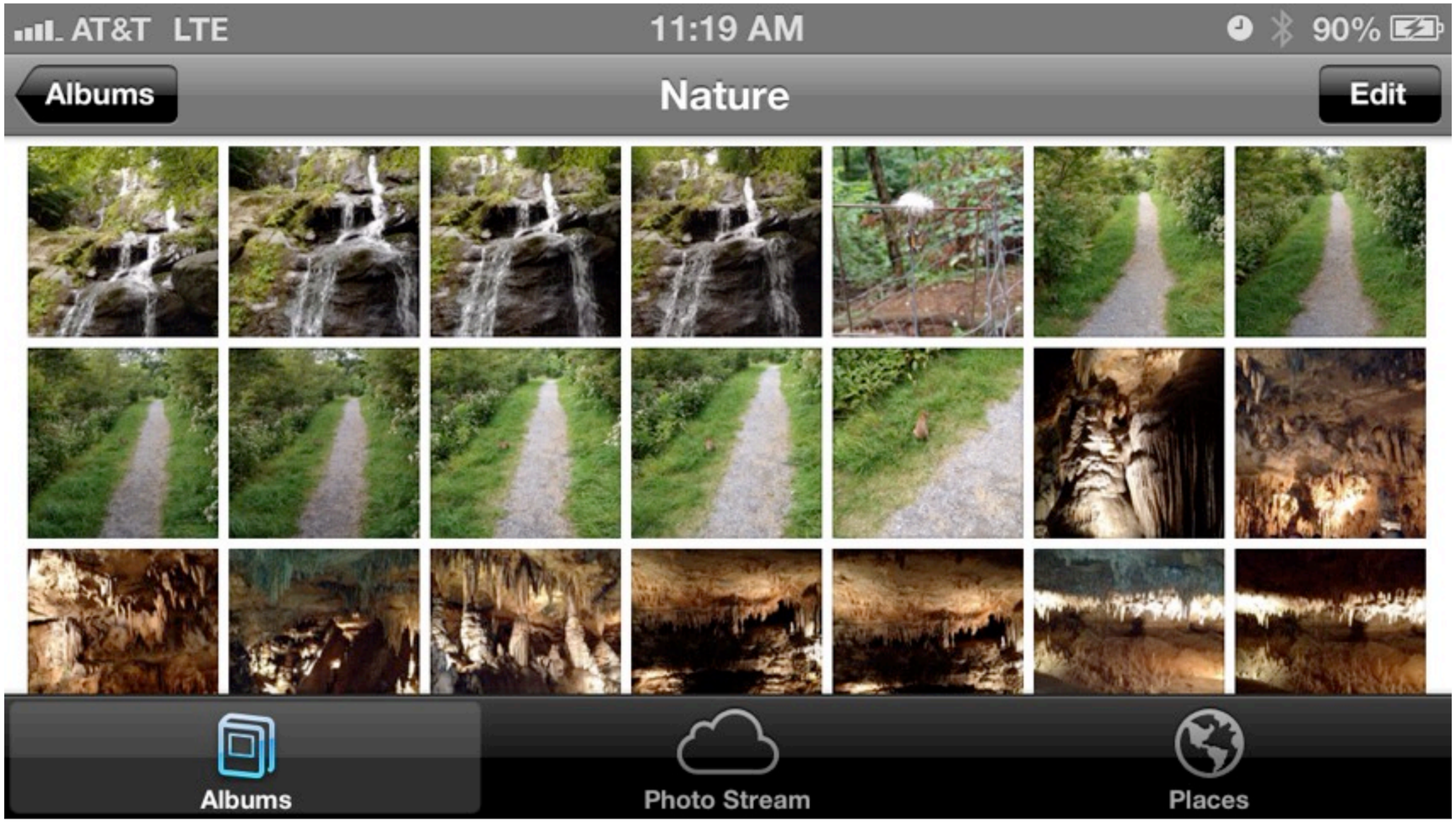
- Introduction
- API
- Flow Layout
- Custom Layouts
- More Customizations
- Summary

Introduction

Where we came from

- Table views

What we also wanted



Grid views and horizontal scrollers

The hard way

- UIScrollView
- manually place “cells”
- DataSource delegate
- delegate for selection, appearance, disappearance, etc.
- create views for cells on demand and cache cells for reuse

What if you wanted something even more complex?

Enter UICollectionView

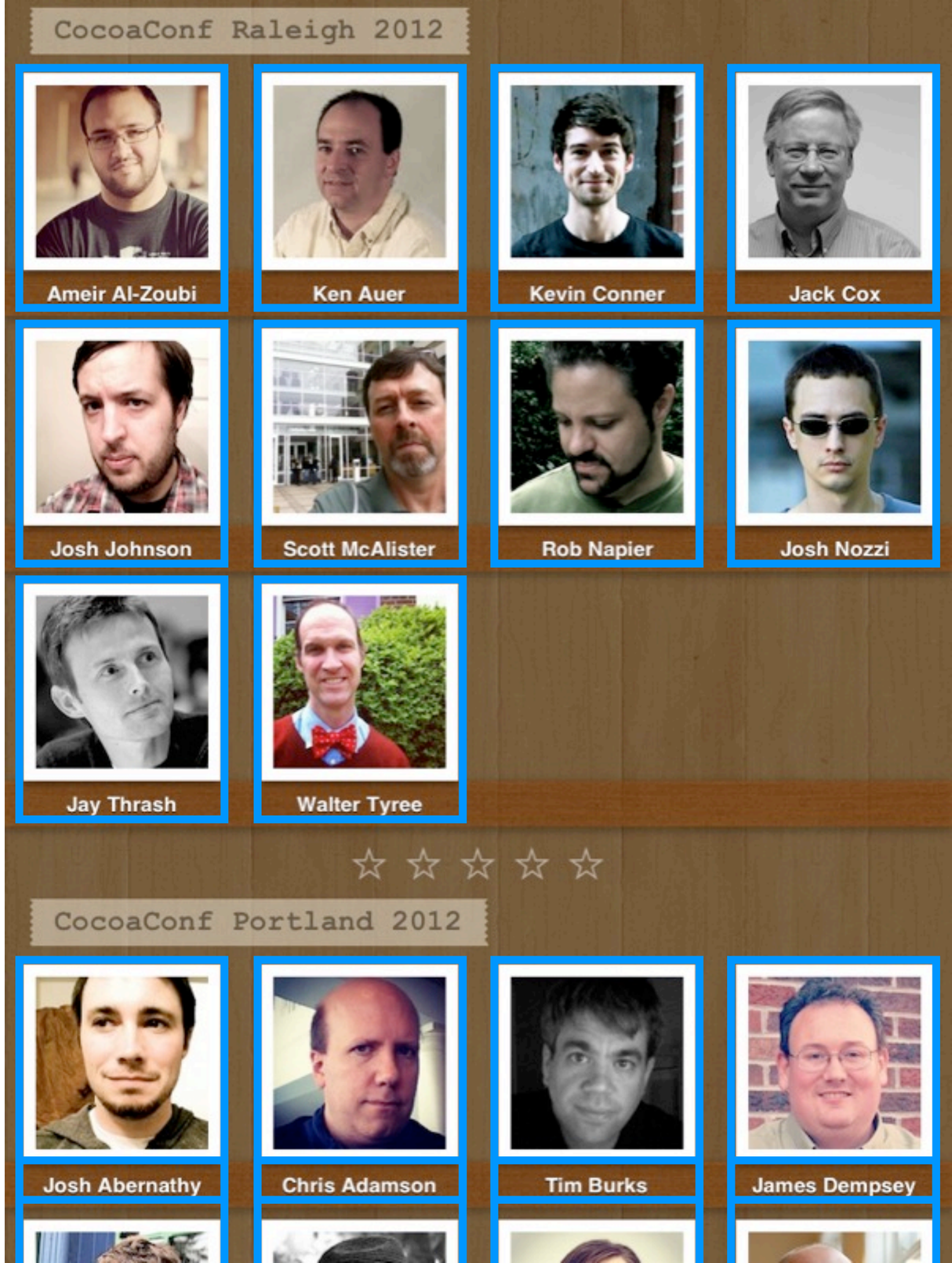
- Handles grids
- Handles horizontal line scrollers
- Handles pretty much any custom layout you can imagine
- High-performance even with large data sets
- Works well with Core Data and NSFetchedResultsController
- Familiar delegate / data source API pattern

Components

- Disclaimer: Never ship programmer art!

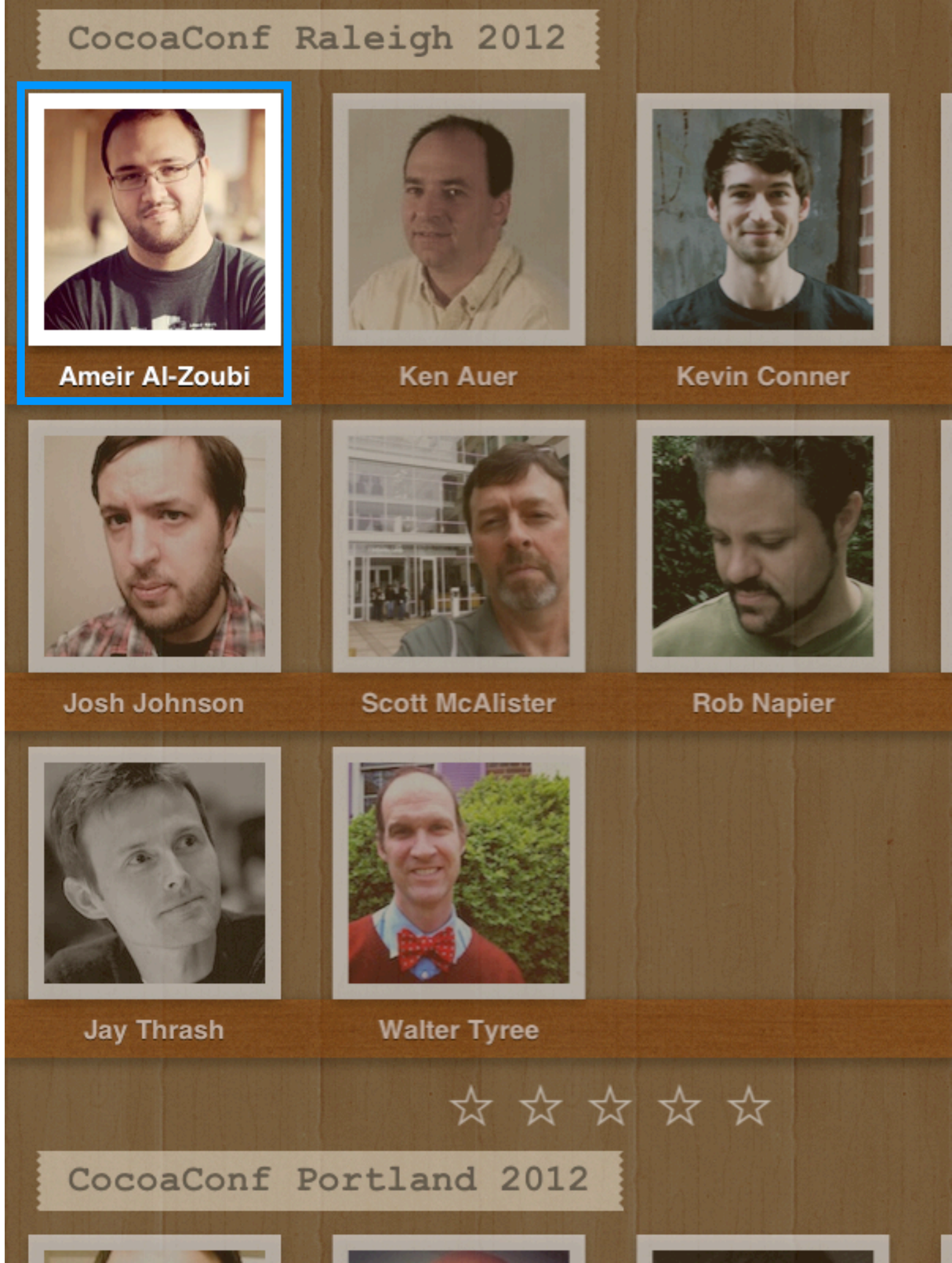
Components

- Cells



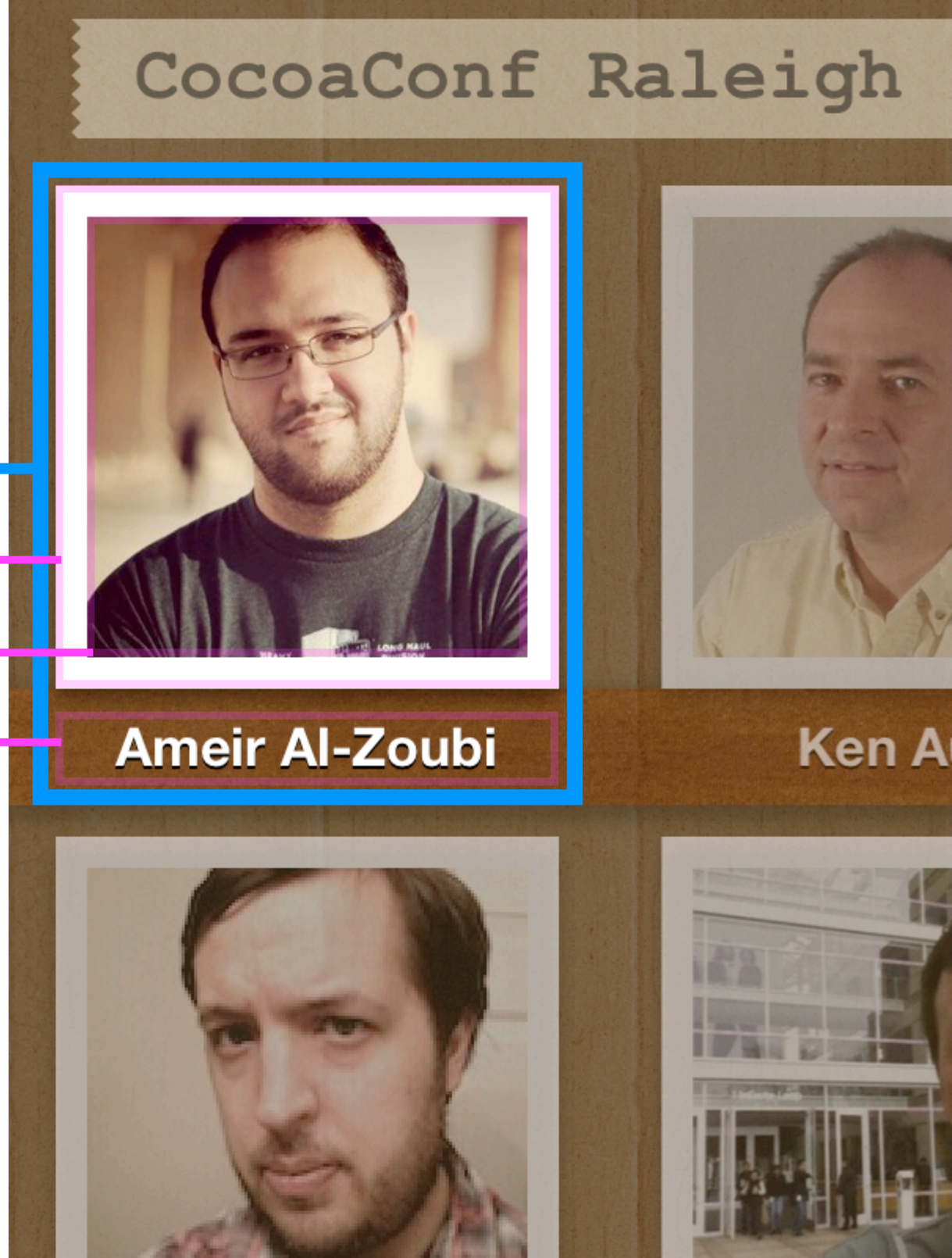
Components

- Cells



Components

- Cells
  - UICollectionViewCell
  - UIView
  - UIImageView
  - UILabel

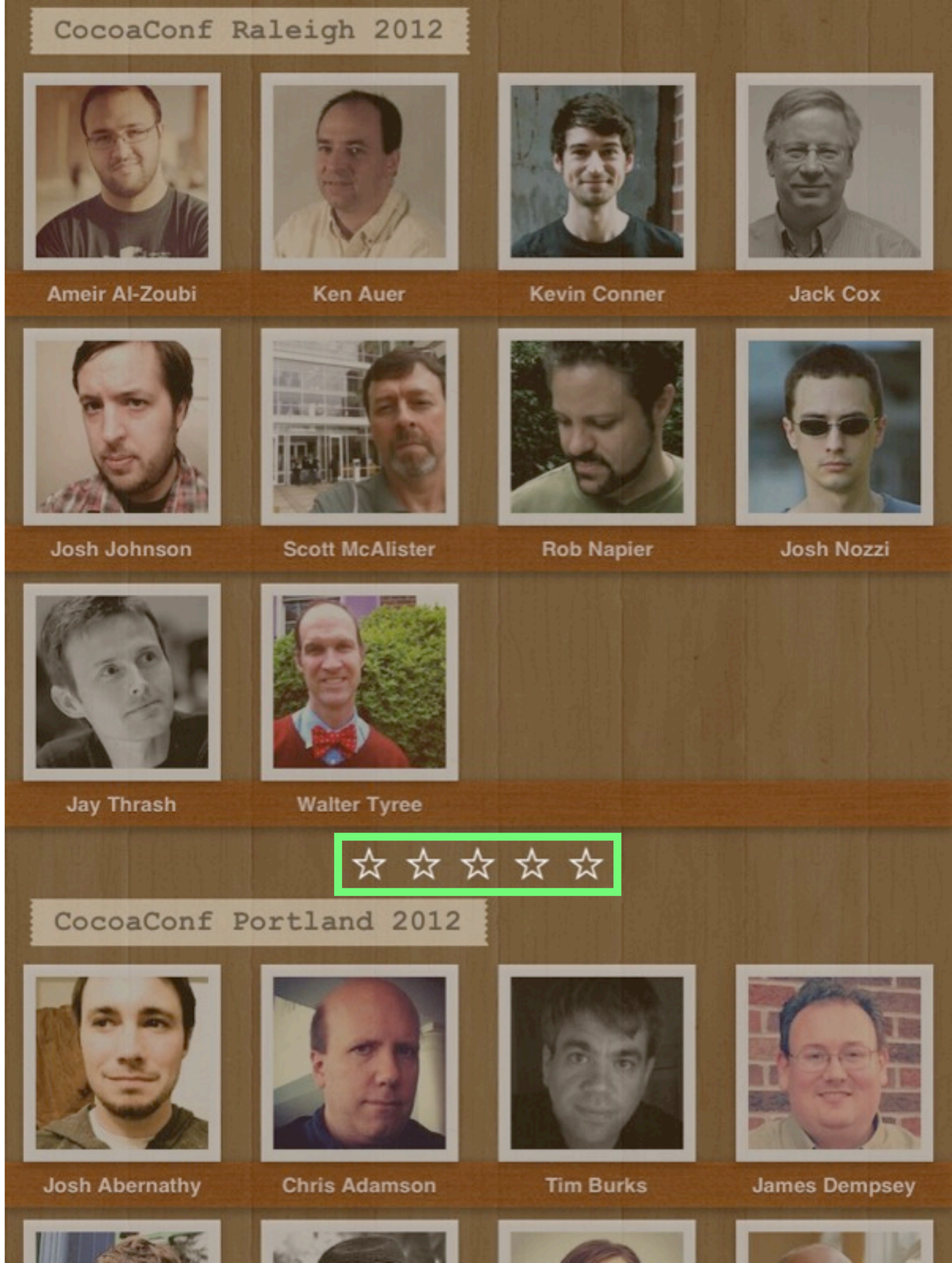


Components

- Cells
- Supplementary Views (headers)

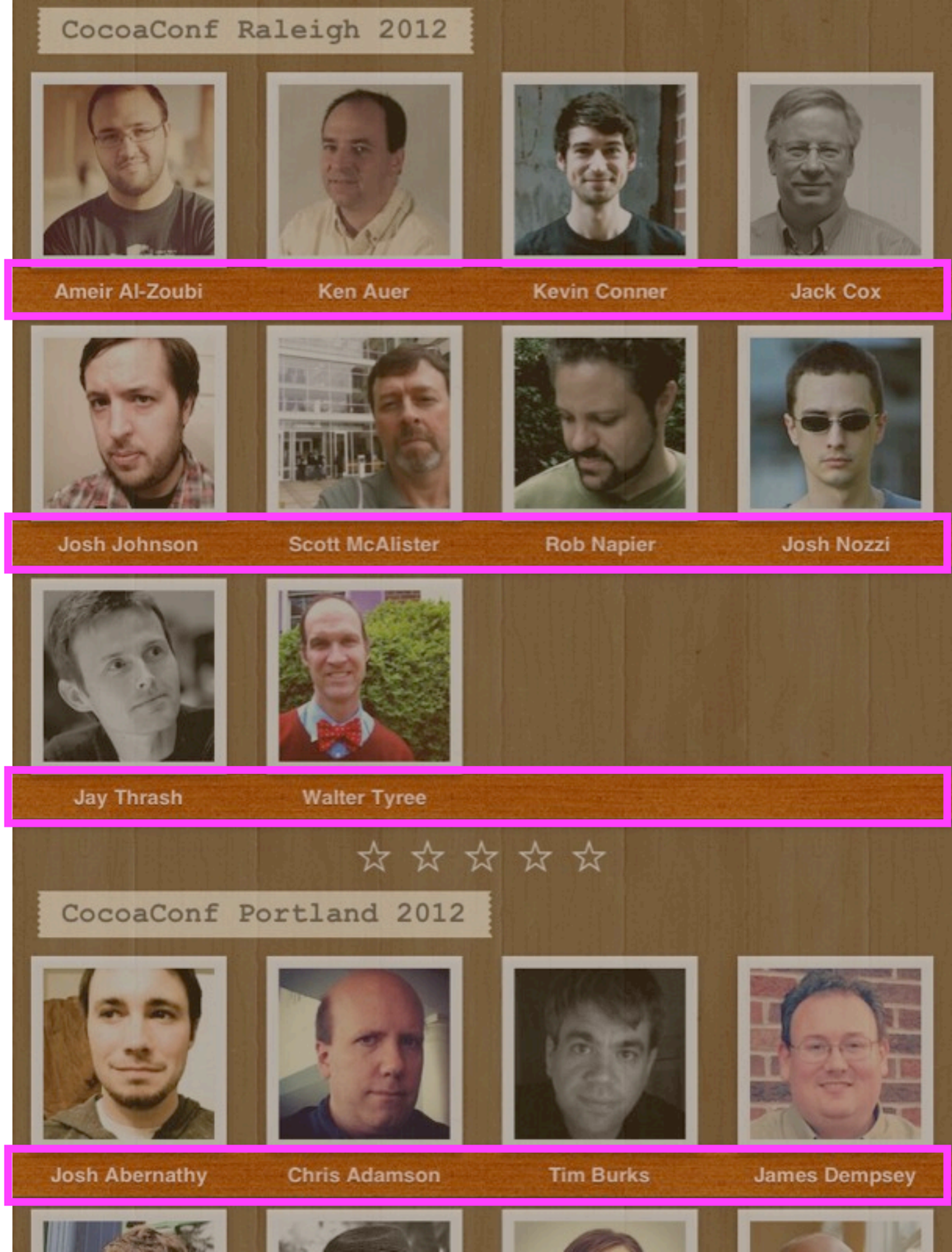
Components

- Cells
- Supplementary Views (headers and footers)



Components

- Cells
- Supplementary Views (headers and footers)
- Decoration Views (everything else)



API

UICollectionView

- If you know how to use UITableView, you mostly know how to use simple Collection Views already

UICollectionViewDataSource

- number of sections

```
- (NSInteger)numberOfSectionsInCollectionView:(UICollectionView *)collectionView
```

- number of items in each section

```
- (NSInteger)collectionView:(UICollectionView *)collectionView numberOfItemsInSection:
(NSInteger)section
```

- configure cells

```
- (UICollectionViewCell *)collectionView:(UICollectionView *)collectionView
cellForItemAtIndexPath:(NSIndexPath *)indexPath
```

- configure supplementary views

```
- (UICollectionReusableView *)collectionView:(UICollectionView *)collectionView
viewForSupplementaryElementOfKind:(NSString *)kind atIndexPath:(NSIndexPath *)indexPath
```

Cell and view reuse

- Cells, supplementary views, and decoration views are all reused
- Each type of view needs to be registered for reuse (nib or class)

```
registerClass:forCellWithReuseIdentifier:

registerNib:forCellWithReuseIdentifier:

registerClass:forSupplementaryViewOfKind:withReuseIdentifier:

registerNib:forSupplementaryViewOfKind:withReuseIdentifier:
```

Cell and view reuse

- Cells, supplementary views, and decoration views are all reused
- Each type of view needs to be registered for reuse (nib or class)
- dequeue will instantiate the class if necessary

```
dequeueReusableCellWithReuseIdentifier:forIndexPath:

dequeueReusableSupplementaryViewOfKind:withReuseIdentifier:forIndexPath:
```

UICollectionViewDelegate

- Manages selecting and highlighting
    - should/did select/deselect
    - should/did highlight/unhighlight
- Tracks the removal of cells
    - didEndDisplay cell/supplementary view
- Manages actions for cells
    - should show menu
    - canPerform/perform action on cell

Layouts

UICollectionViewLayout

- Tells the collection view about position, size, and visual state of items in the collection

- abstract class

UICollectionViewFlowLayout

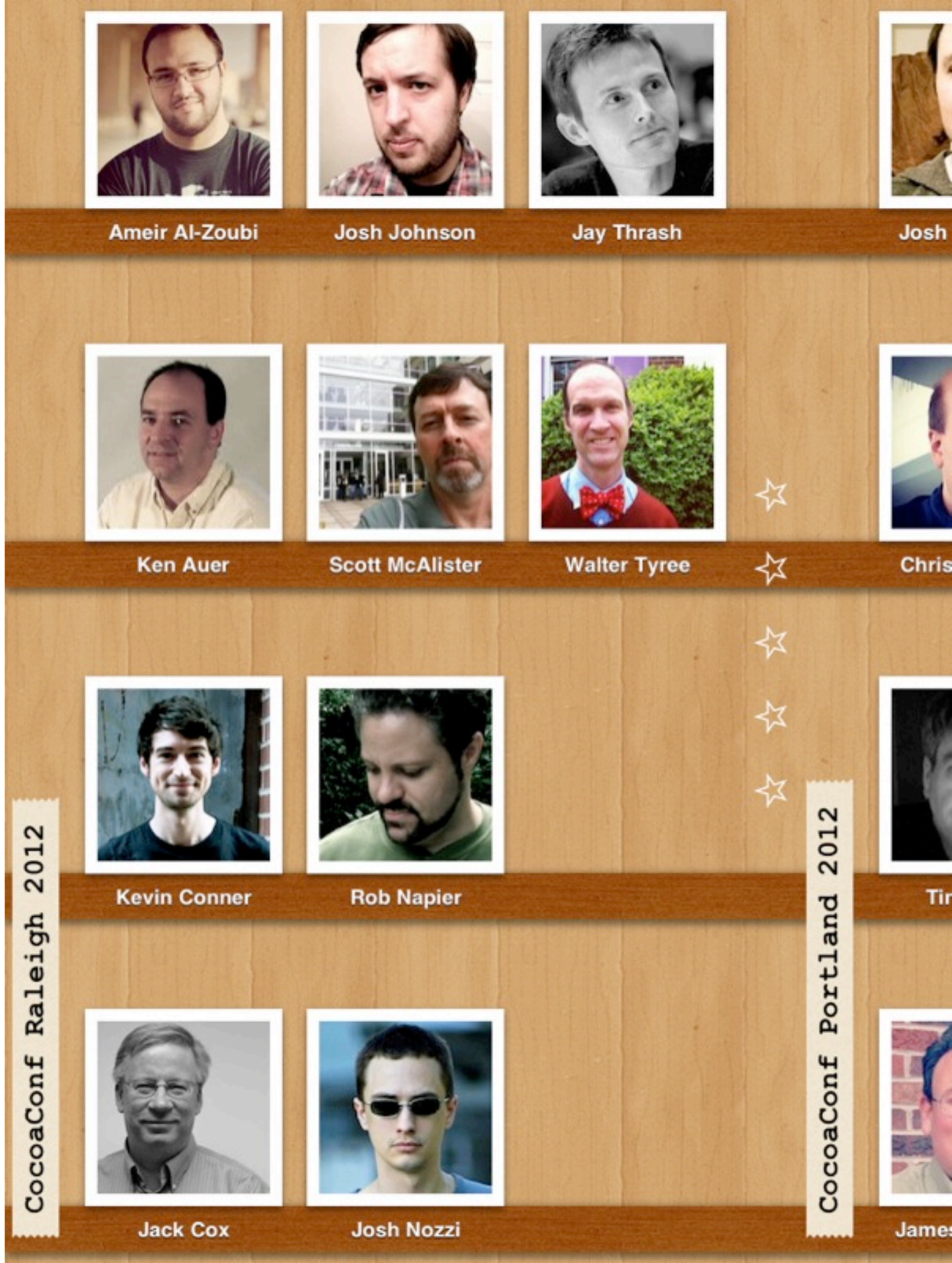
- Subclass of UICollectionViewLayout for grids
- Makes it super easy to implement basic grids
- Supports headers and footers
- Can be customized via properties or by delegate
    - property = global
    - delegate = per item or section
- Can be subclassed

UICollectionViewFlowLayout

- scroll direction

UICollectionViewFlowLayout

- scroll direction

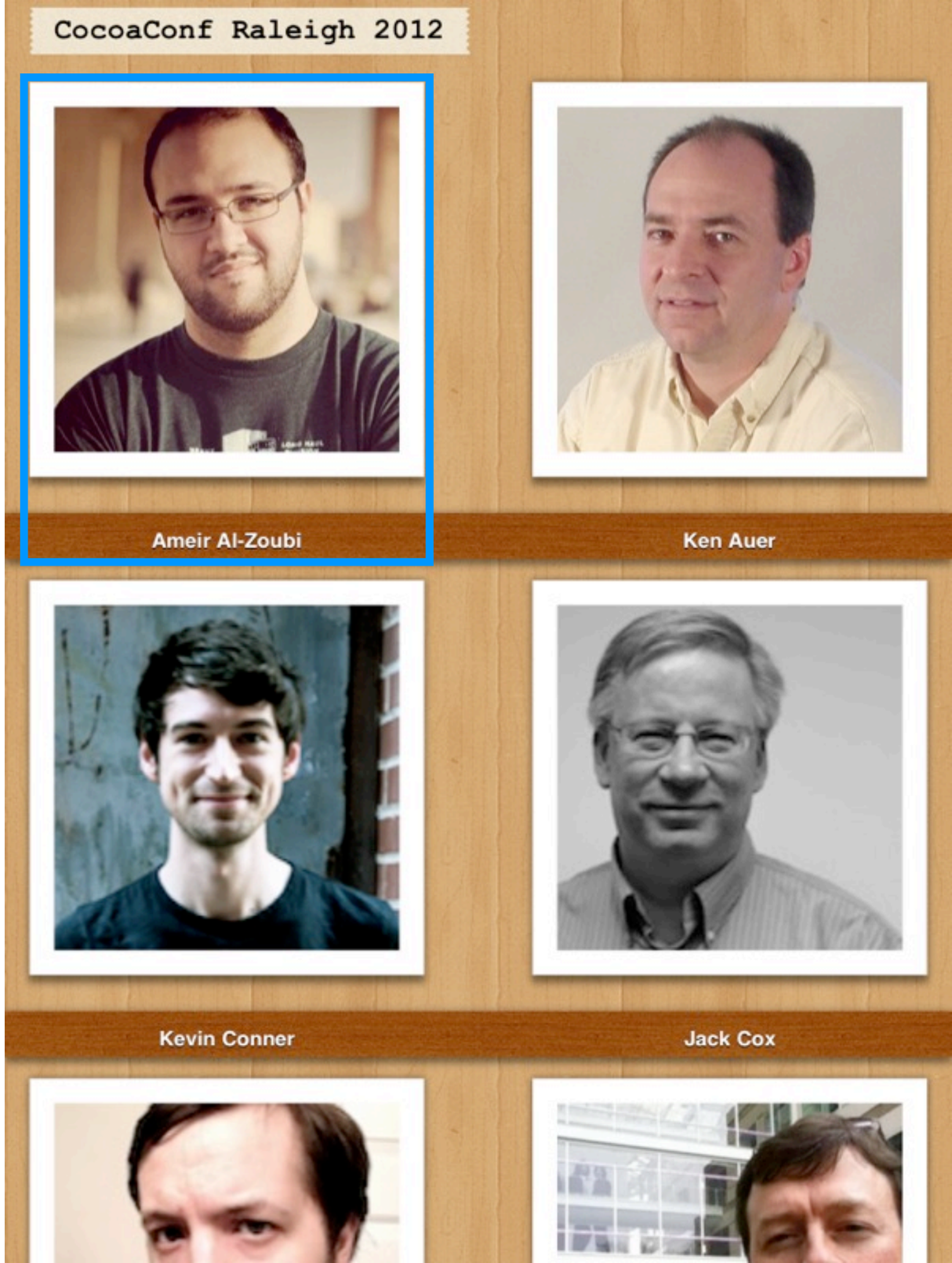


UICollectionViewFlowLayout

- scroll direction
- itemSize

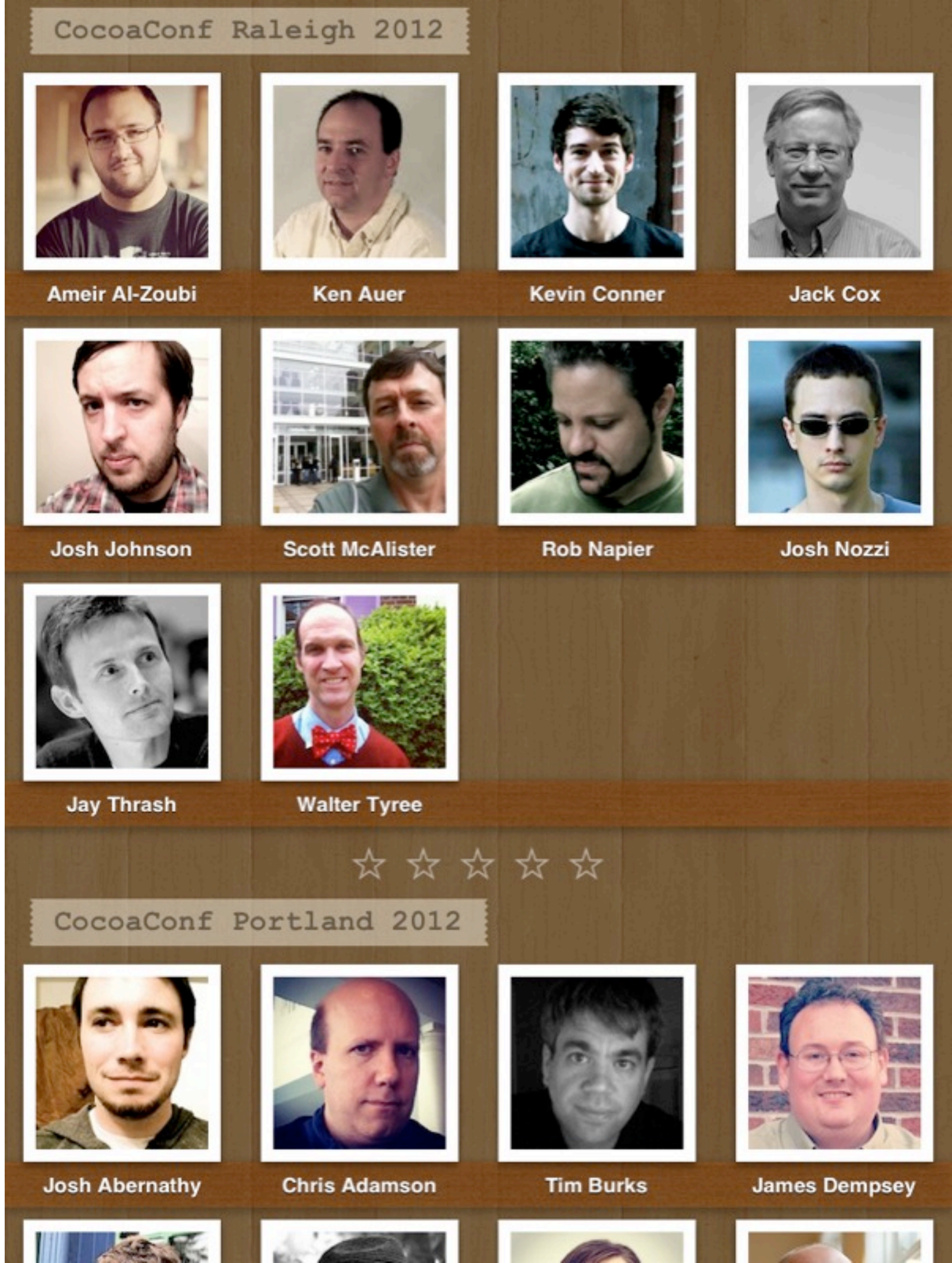
UICollectionViewFlowLayout

- scroll direction
- itemSize



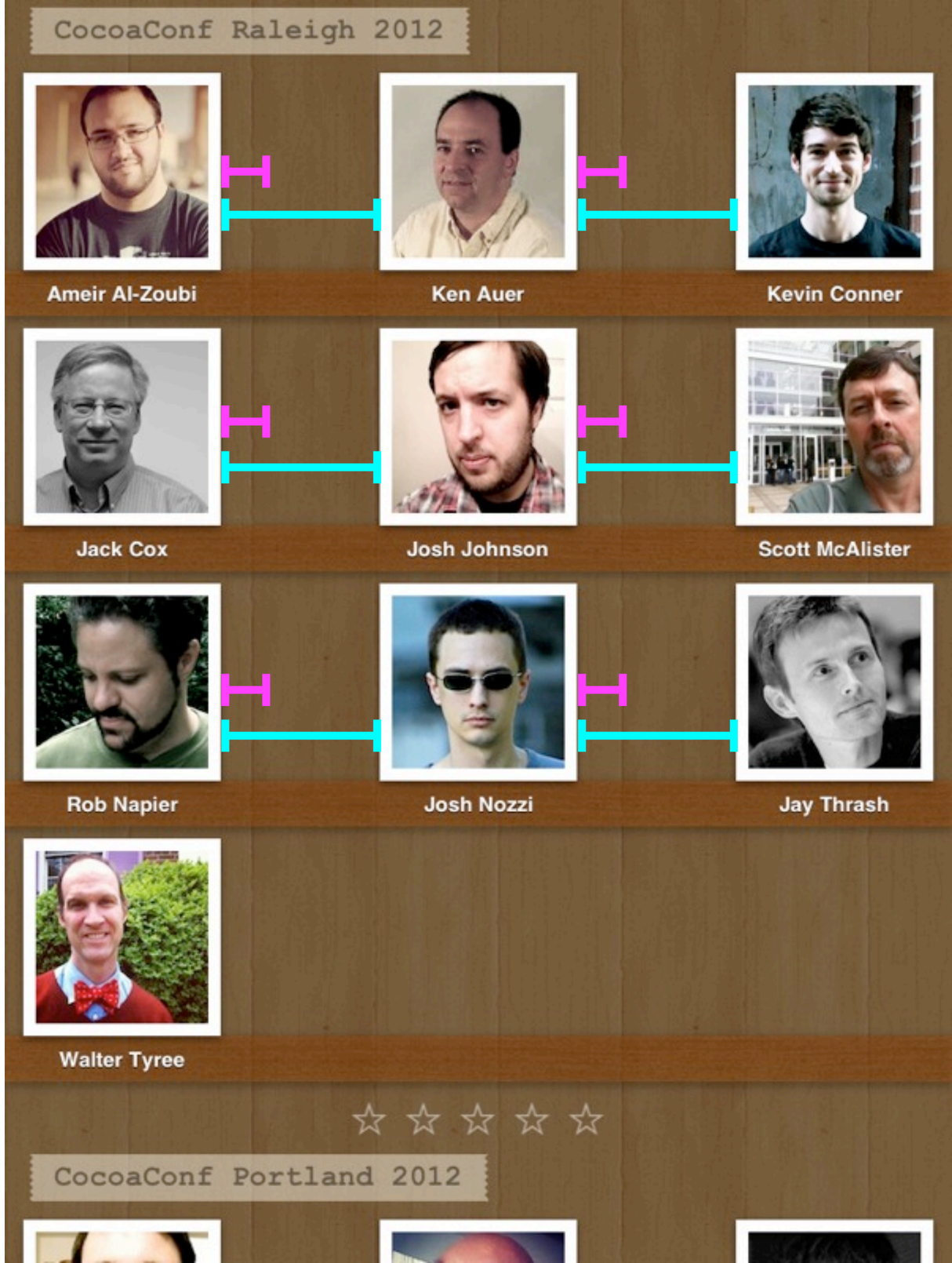
UICollectionViewFlowLayout

- scroll direction
- itemSize
- minimumInteritemSpacing



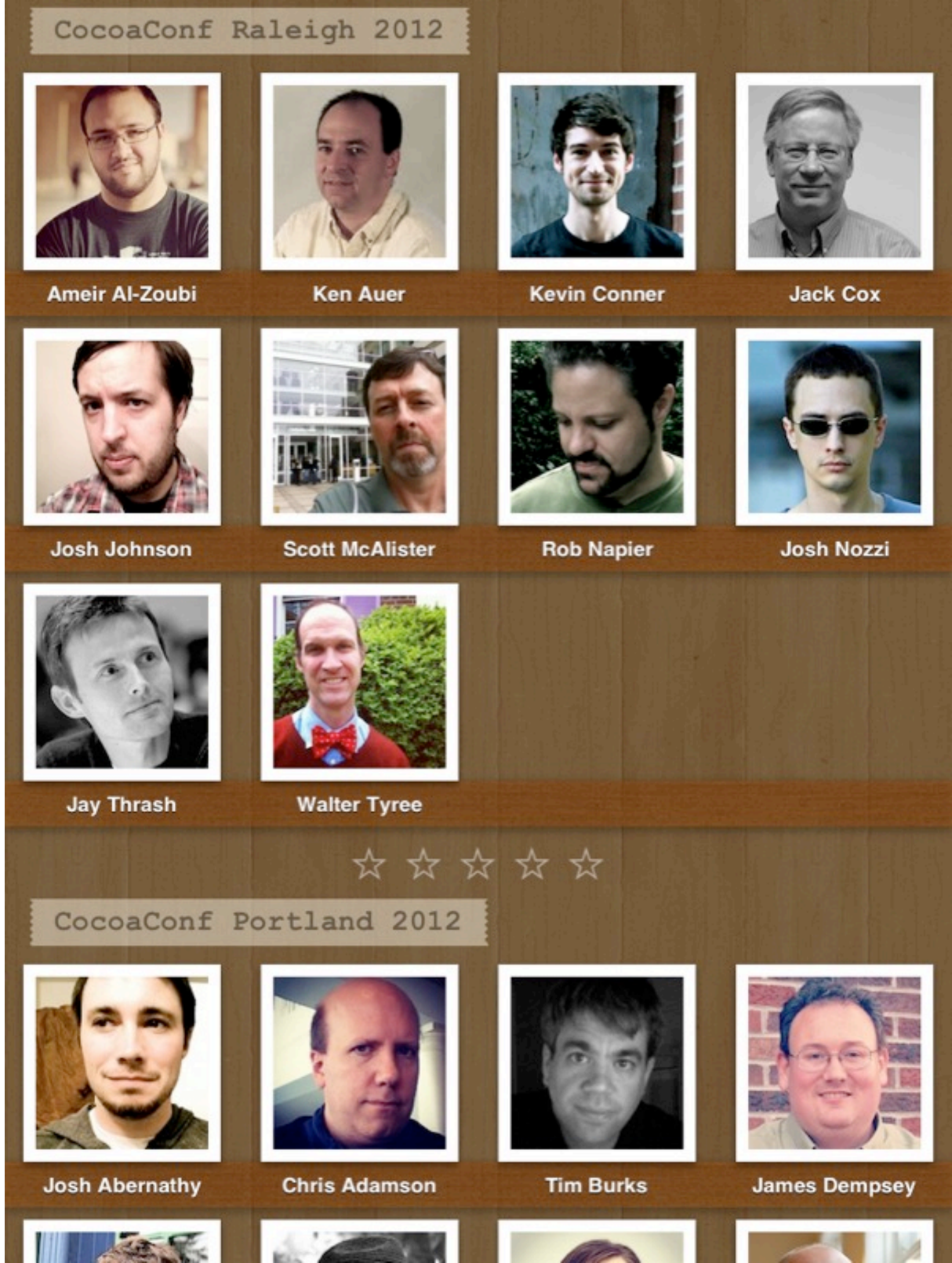
UICollectionViewFlowLayout

- scroll direction
- itemSize
- minimumInteritemSpacing
  - minimum spacing
  - actual spacing



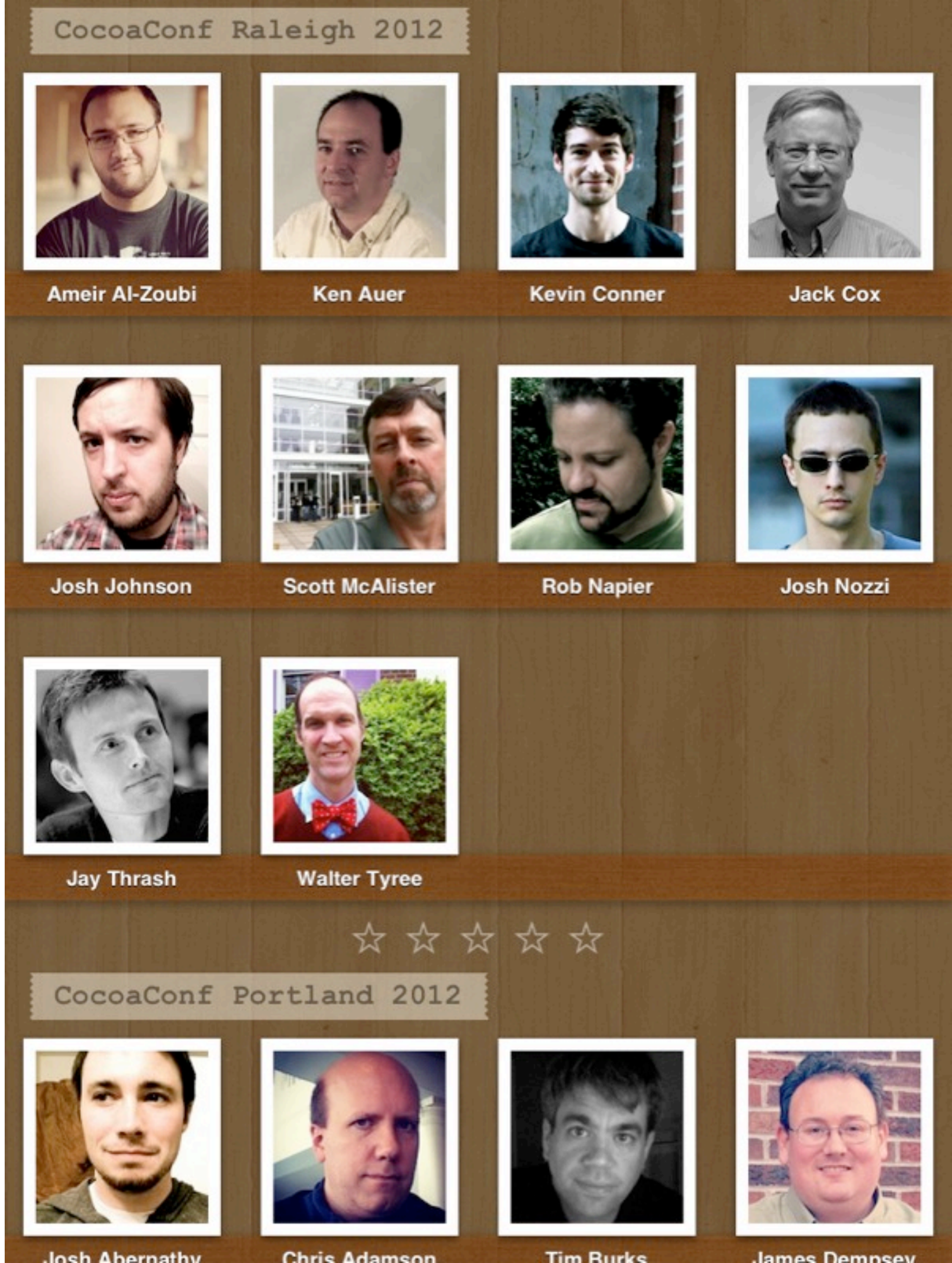
UICollectionViewFlowLayout

- scroll direction
- itemSize
- minimumInteritemSpacing
- minimumLineSpacing



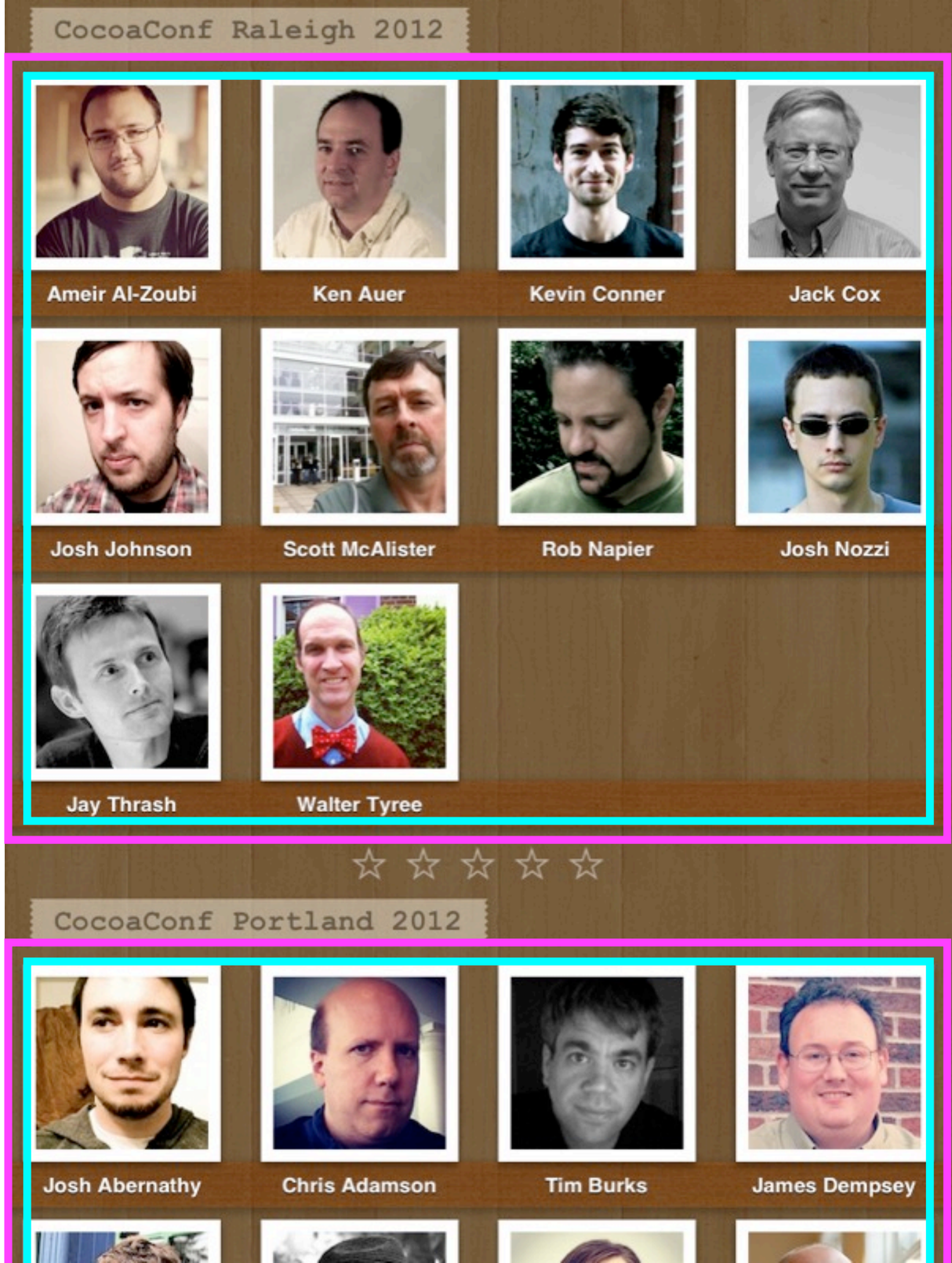
UICollectionViewFlowLayout

- scroll direction
- itemSize
- minimumInteritemSpacing
- minimumLineSpacing



UICollectionViewFlowLayout

- scroll direction
- itemSize
- minimumInteritemSpacing
- minimumLineSpacing
- sectionInset



UICollectionViewFlowLayout

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- minimumInteritemSpacing
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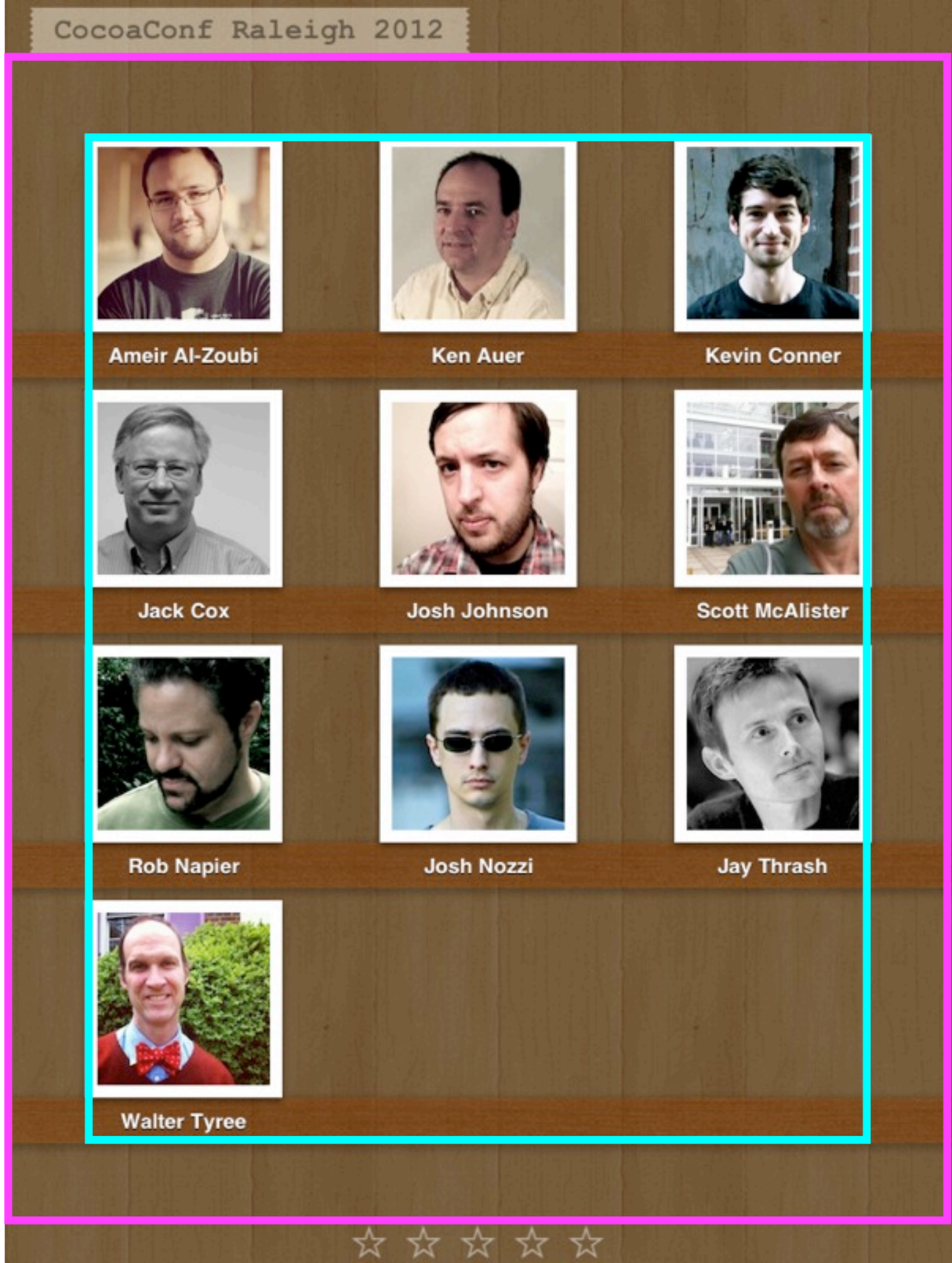
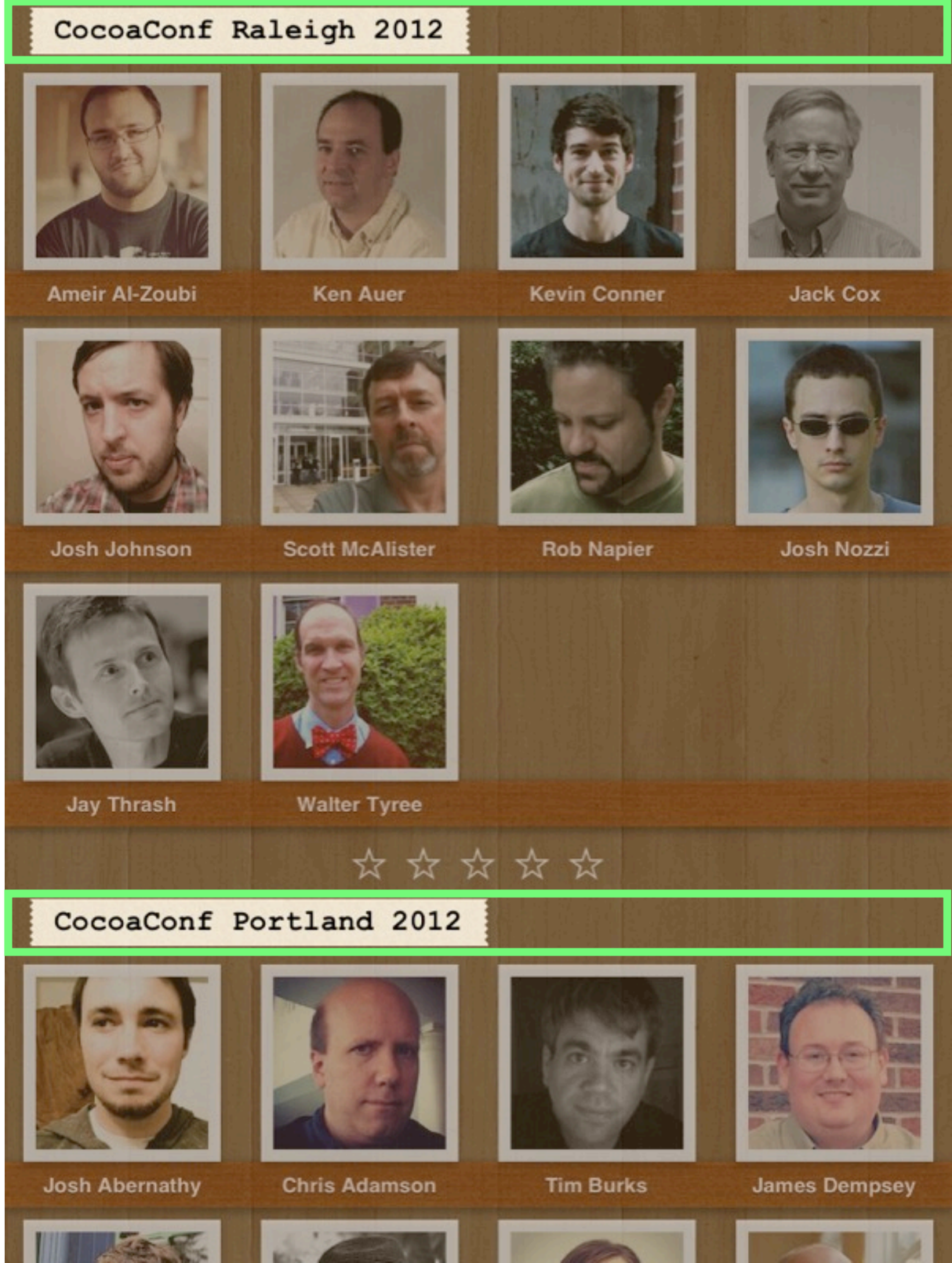


UICollectionViewFlowLayout

- scroll direction
- itemSize
- minimumInteritemSpacing
- minimumLineSpacing
- sectionInset
- headerReferenceSize



UICollectionViewFlowLayout

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- itemSize
- minimumInteritemSpacing
- minimumLineSpacing
- sectionInset
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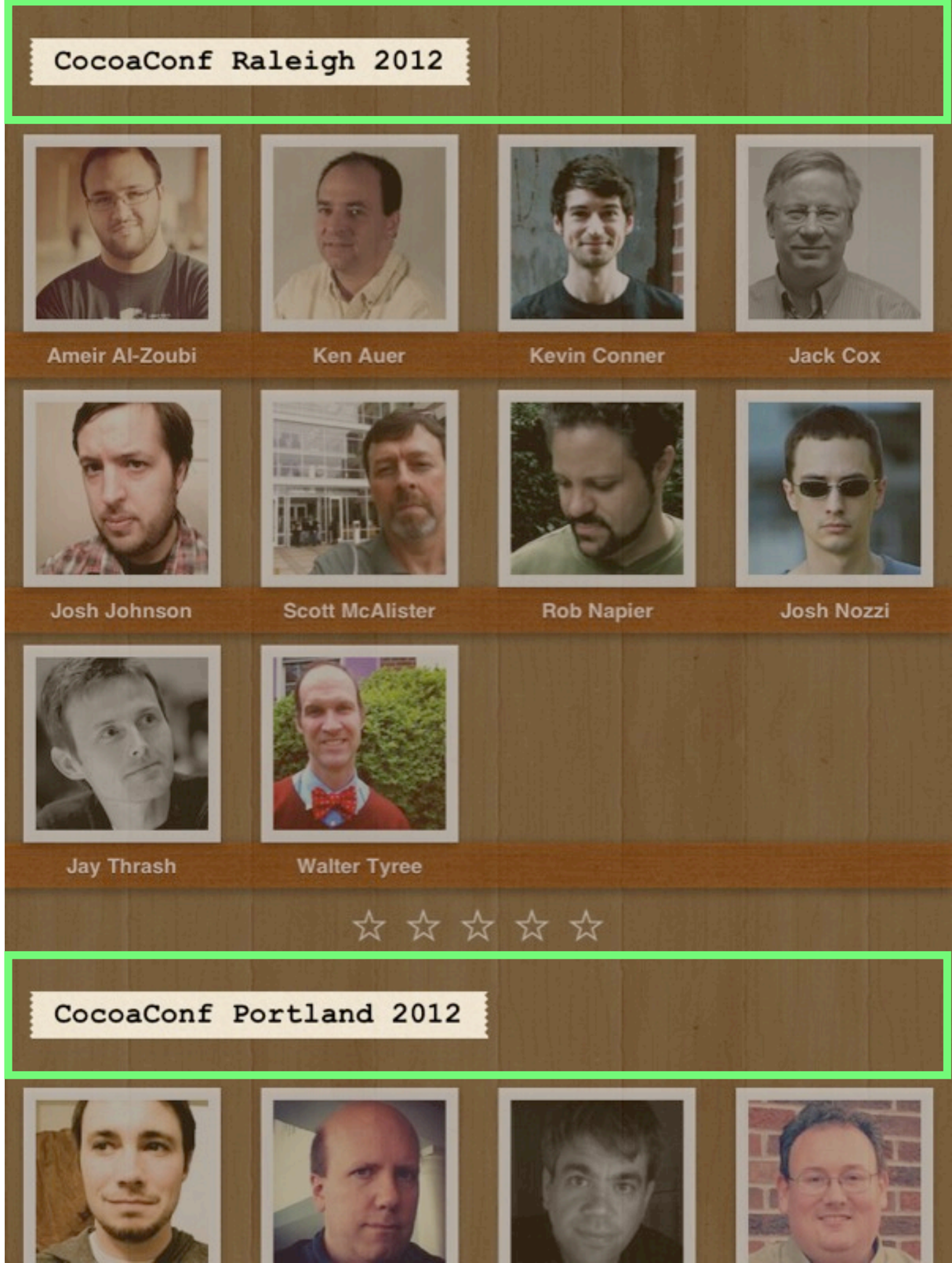

UICollectionViewFlowLayout

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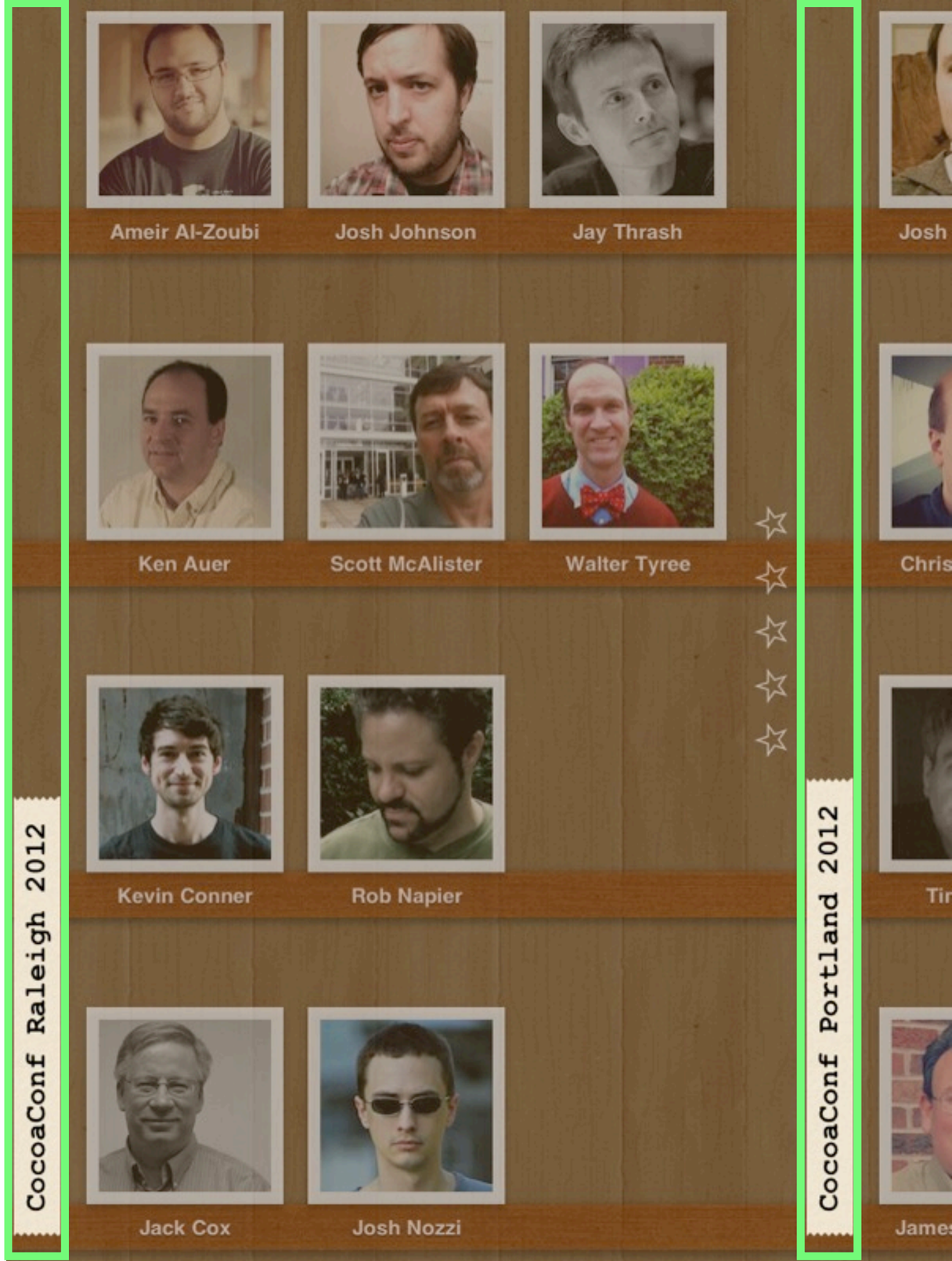

UICollectionViewFlowLayout

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- minimumInteritemSpacing
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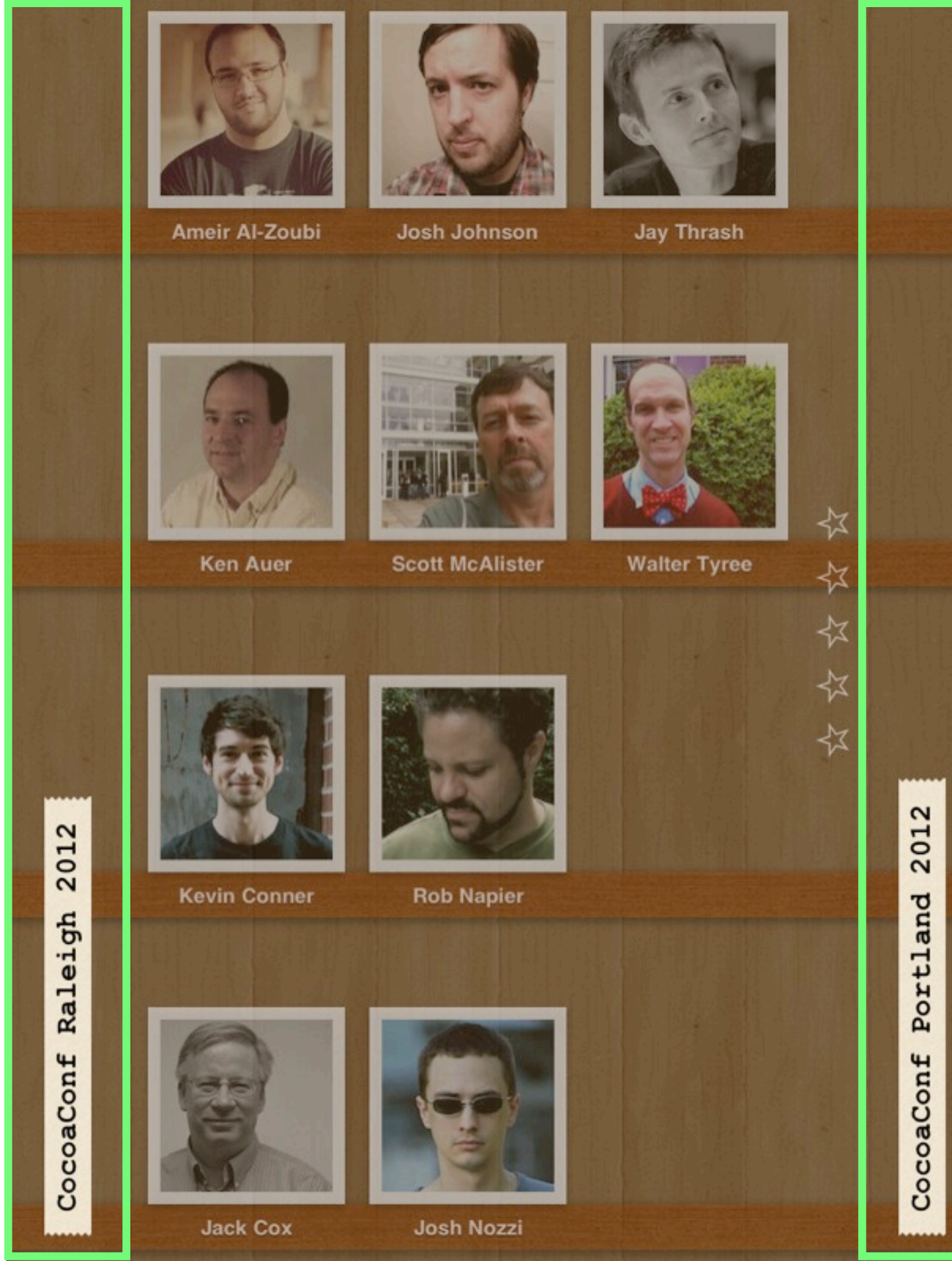
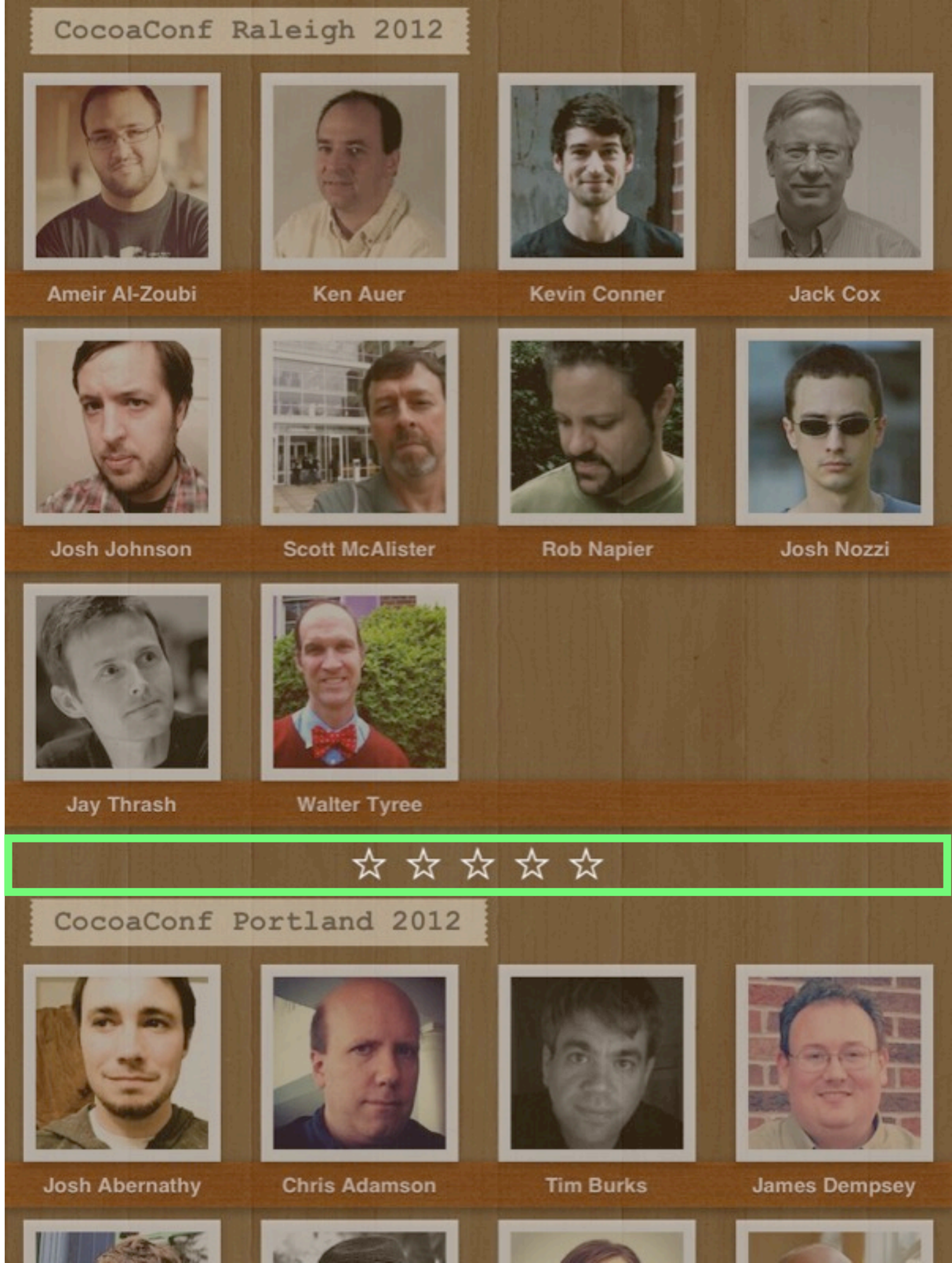


UICollectionViewFlowLayout

- scroll direction
- itemSize
- minimumInteritemSpacing
- minimumLineSpacing
- sectionInset
- headerReferenceSize
- footerReferenceSize



UICollectionViewFlowLayout

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- minimumInteritemSpacing
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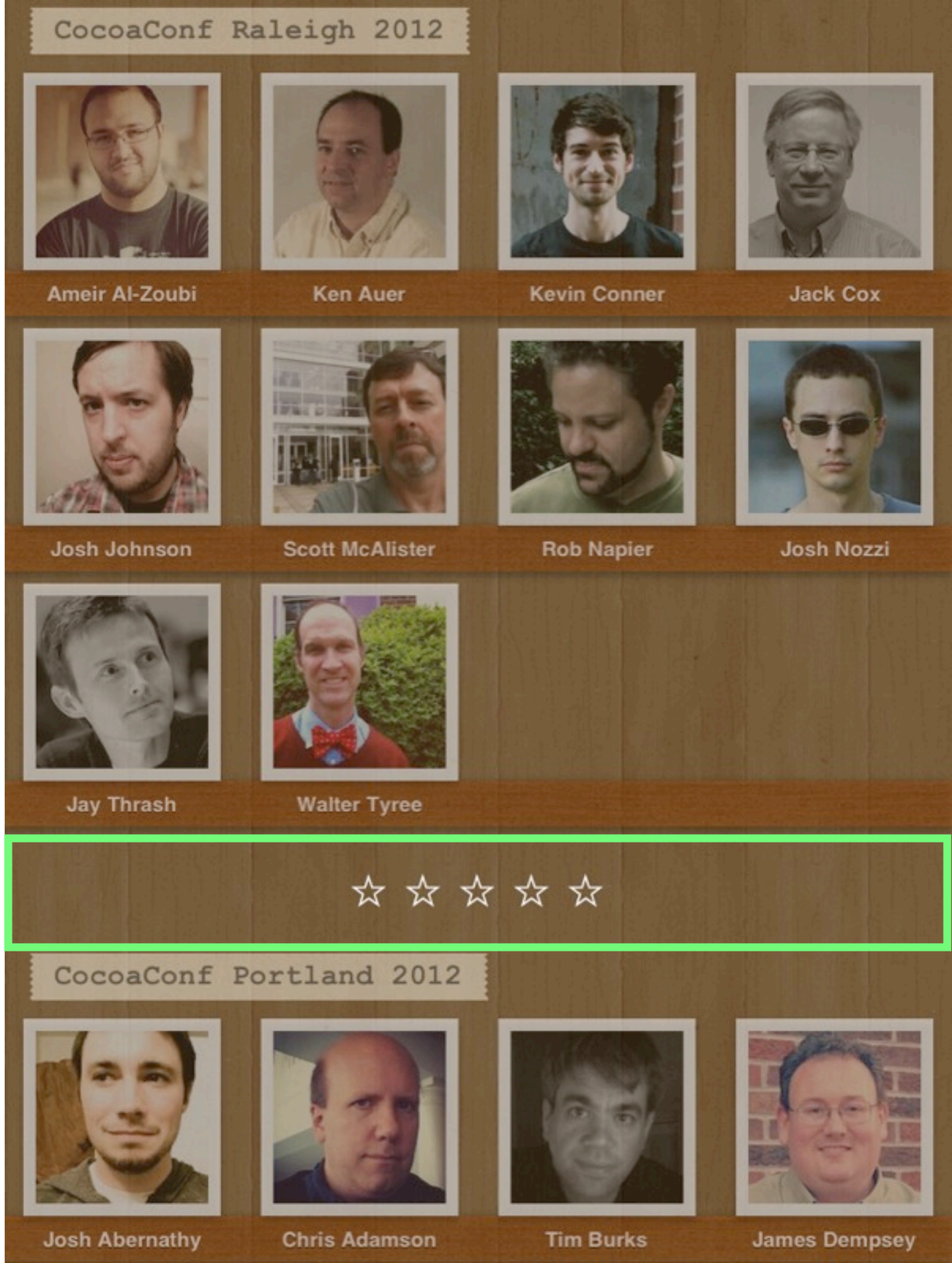

UICollectionViewFlowLayout

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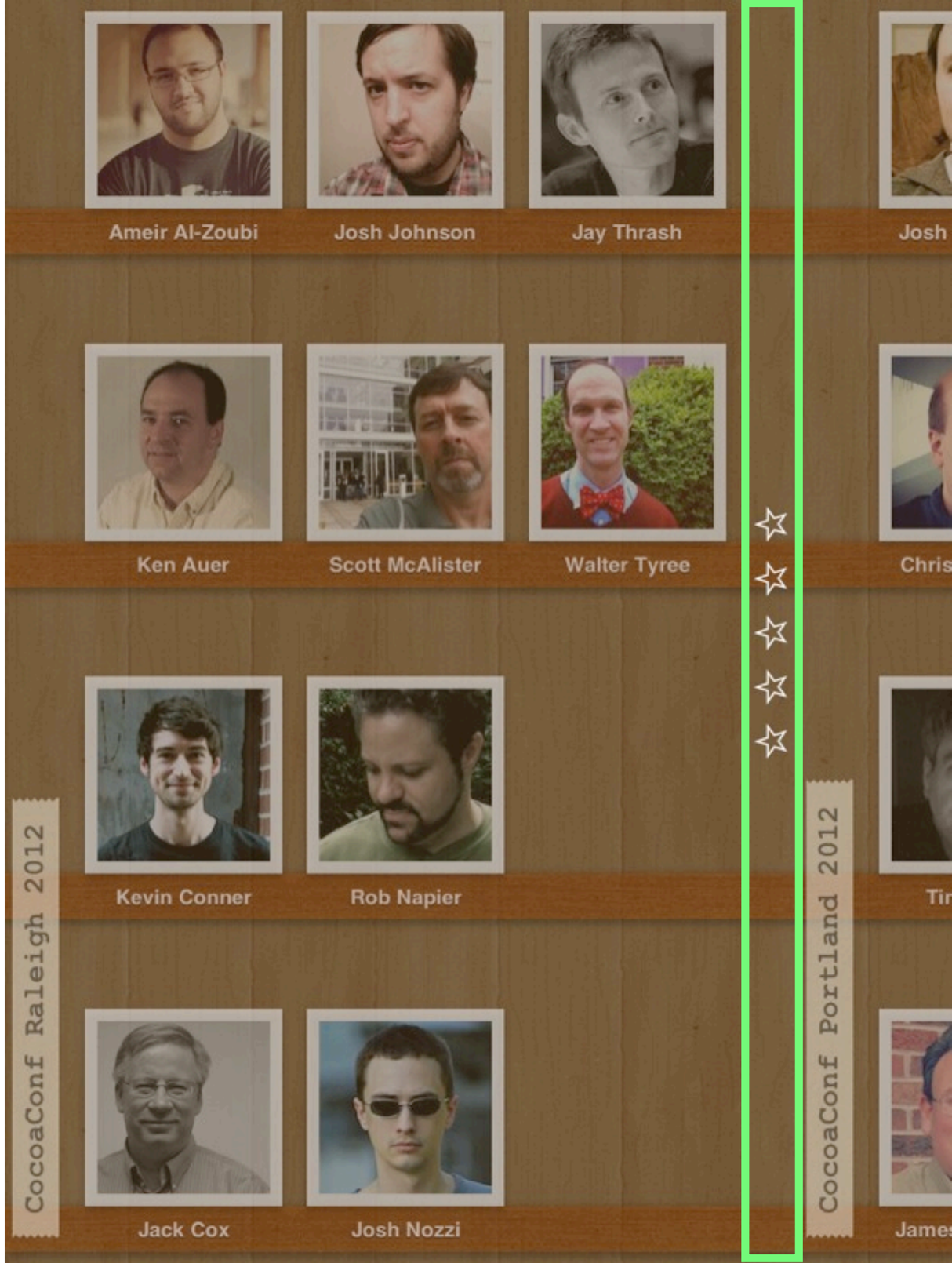

UICollectionViewFlowLayout

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- itemSize
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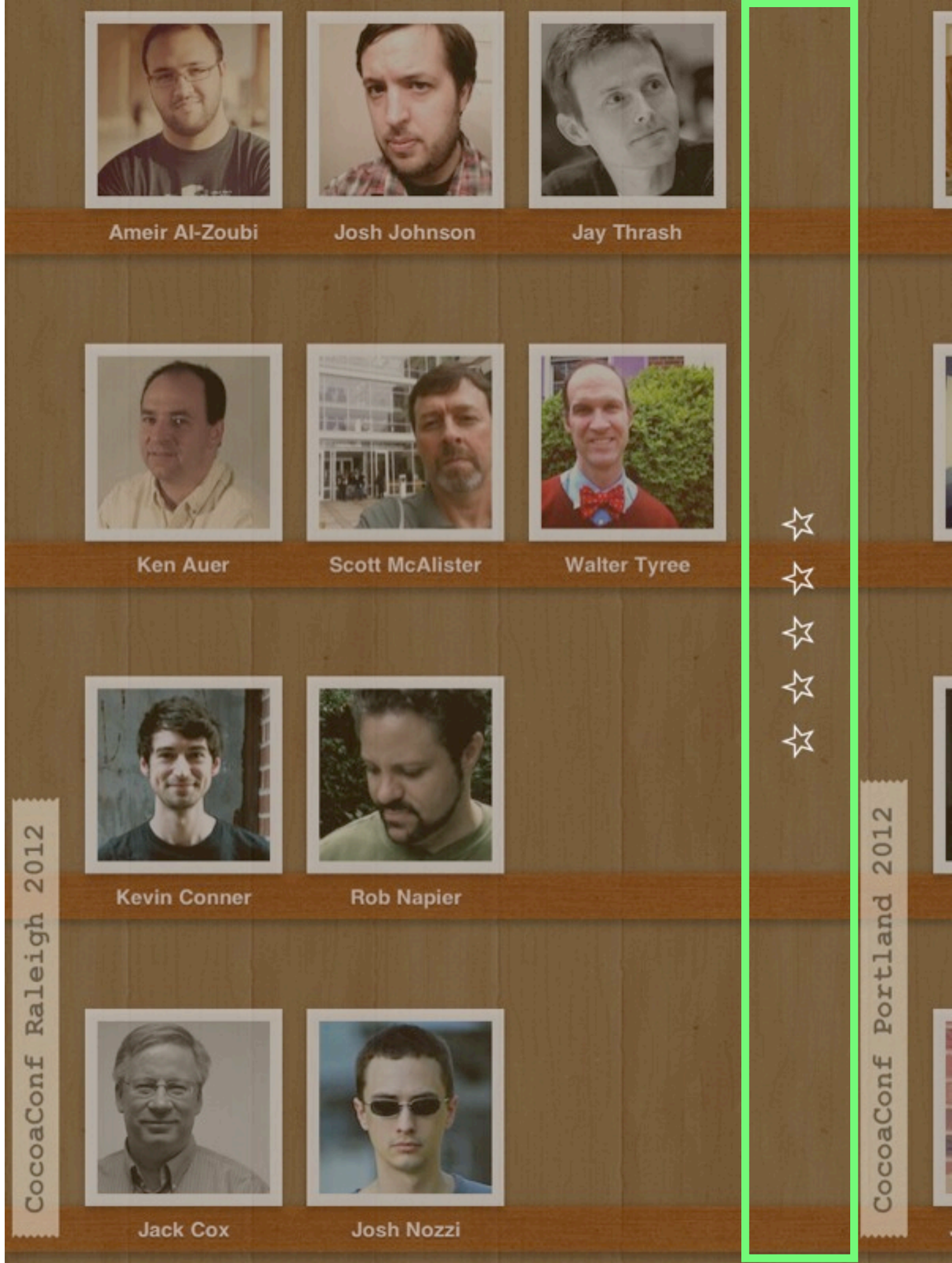


UICollectionViewDelegateFlowLayout

- extends UICollectionViewDelegate
- customize per section (size per item)

UICollectionViewFlowLayout

- `itemSize`
- `minimumInteritemSpacing`
- `minimumLineSpacing`
- `sectionInset`
- `referenceSizeForHeader`
- `referenceSizeForFooter`

UICollectionViewDelegateFlowLayout

- – collectionView:layout:sizeForItemAtIndexPath:
- – collectionView:layout:minimumInteritemSpacingForSectionAtIndex:
- – collectionView:layout:minimumLineSpacingForSectionAtIndex:
- – collectionView:layout:insetForSectionAtIndex:
- – collectionView:layout:referenceSizeForHeaderInSection:
- – collectionView:layout:referenceSizeForFooterInSection:

DEMO

Flow Layouts

Custom Layouts

UICollectionViewLayoutAttributes

- Describe position, size, visual state of collection items
- Apply to cells, supplementary views, and decoration views
- Set by layout
- Used by collection view to configure cells and views
- Subclass to add additional attributes

UICollectionViewLayoutAttributes

- position
- size
- opacity
- zIndex
- transform

When to subclass UICollectionViewFlowLayout

- add decoration views
- add extra supplementary views (beyond headers and footers)
- adjust the default layout attributes of items
- add new layout attributes
- use custom insert or delete animations

When to subclass UICollectionViewLayout

- The layout you want is nothing like a grid
- You'd have to change the default attributes so much that it would be less work to not derive from flow layout

How UICollectionViewLayout works

- prepareLayout
- collectionViewContentSize
- layoutAttributesForElementsInRect:
  - provide layout attributes on demand

```
layoutAttributesForItemAtIndexPath:

layoutAttributesForSupplementaryViewOfKind:atIndexPath:

layoutAttributesForDecorationViewOfKind:atIndexPath:
```

- invalidateLayout

Invalidating layouts

- explicit: invalidateLayout
- implicit: performBatchUpdates:completion:
- implicit: override shouldInvalidateLayoutForBoundsChange:

```
- (BOOL)shouldInvalidateLayoutForBoundsChange:(CGRect)oldBounds
```

- called when contentOffset changes or when bounds change
- always return YES
- return YES only if bounds change

Miscellaneous Tips

- don’t use collectionView.frame / bounds outside of prepareLayout
- consider setting hidden = YES instead of alpha = 0

DEMO

Custom Layouts

More Customizations

More Customizations

- Decoration Views
- Custom Layout Attributes
- Custom Insert & Delete Animations

How to add decoration views

- Create your own layo

- Register your decora

```
registerNib:forDecora

registerClass:forDecc
```

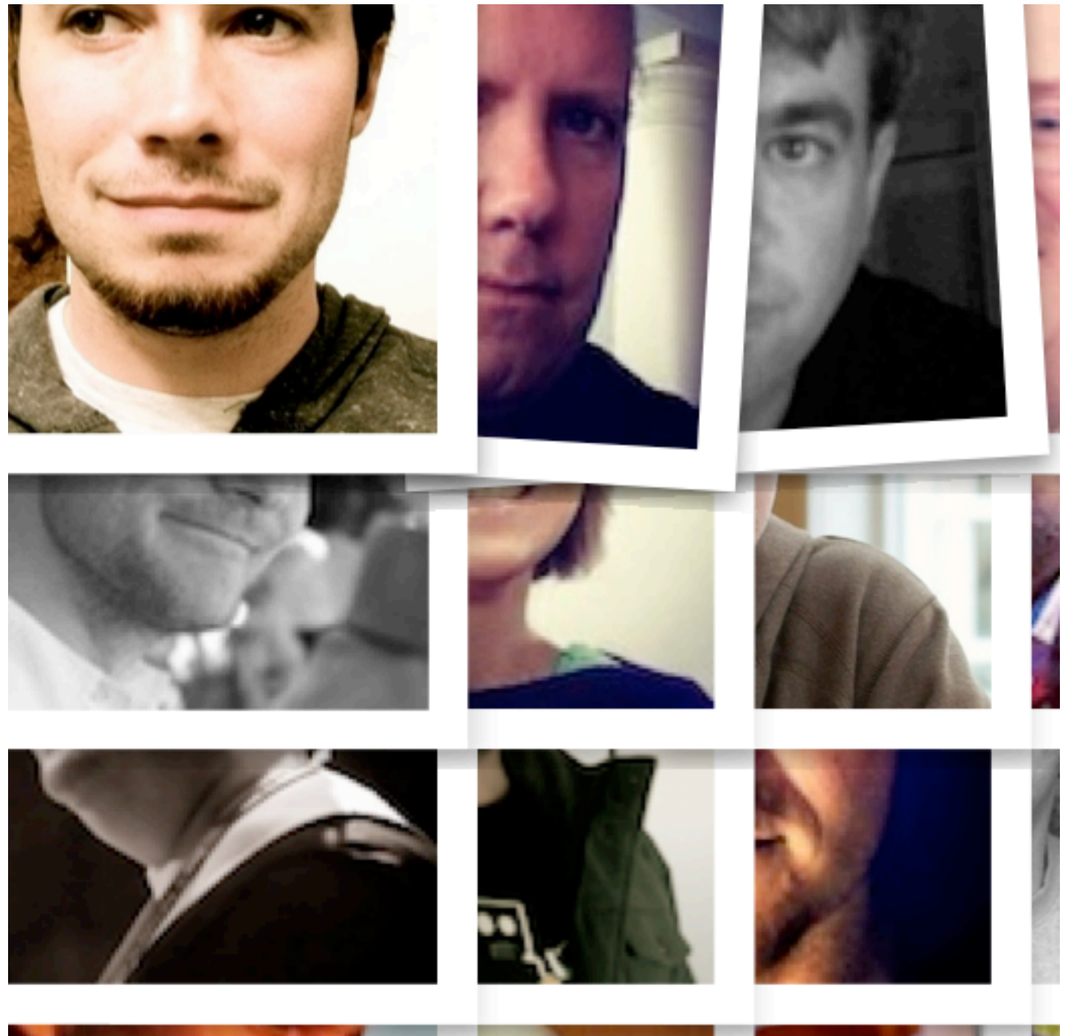
- Return attributes for

```
layoutAttributesForEl

layoutAttributesForDe
```

When to subclass UICollectionViewLayoutAttributes

- You need additional attributes beyond those found in the base class



How to create custom attributes

- Subclass UICollectionViewLayoutAttributes
  - add additional properties
  - Important! You must implement copyWithZone:

```
- (id)copyWithZone:(NSZone *)zone
{
    CustomAttributes *attributes = [super copyWithZone:zone];

    attributes.customProperty = self.customProperty;

    return attributes;
}
```

How to create custom attributes

- Subclass UICollectionViewLayoutAttributes
- Subclass UICollectionViewLayout (or flow layout)
    - implement layoutAttributesClass to return your custom class

```
+ (Class)layoutAttributesClass
{
    return [CustomAttributes class];
}
```

How to create custom attributes

- Subclass UICollectionViewLayoutAttributes
- Subclass UICollectionViewLayout (or flow layout)
    - implement layoutAttributesClass to return your custom class
    - set your custom attributes

```
layoutAttributesForElementsInRect:

layoutAttributesForItemAtIndexPath:

layoutAttributesForSupplementaryViewOfKind:atIndexPath:

layoutAttributesForDecorationViewOfKind:atIndexPath:
```

How to create custom attributes

- Subclass UICollectionViewLayoutAttributes
- Subclass UICollectionViewLayout (or flow layout)
- In your cell, supplementary view, or decoration view classes implement applyLayoutAttributes:

```
- (void)applyLayoutAttributes:(UICollectionViewLayoutAttributes *)layoutAttributes
{
    if ([layoutAttributes isKindOfClass:[CustomAttributes class]])
    {
        CustomAttributes *customAttributes = (CustomAttributes *)layoutAttributes;

        // Do something interesting with them
    }
}
```

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Custom layout attributes

UICollectionView animations

- switch layout
```
- (void)setCollectionViewLayout:animated:
```
- insert items
```
- (void)insertItemsAtIndexPaths:
```
- delete items
```
- (void)deleteItemsAtIndexPaths:
```
- move items
```
- (void)moveItemAtIndexPath:toIndexPath:
```

Delete animations

- Deleted item fades away
- Remaining items move to their new positions

Customizing delete animations

- override finalLayoutAttributesForDisappearingItemAtIndexPath:

```
- (UICollectionViewLayoutAttributes *)finalLayoutAttributesForDisappearingItemAtIndexPath:
    (NSIndexPath *)itemIndexPath
{
    UICollectionViewLayoutAttributes* attributes = [self
        layoutAttributesForItemAtIndexPath:itemIndexPath];

    // Configure attributes ...

    return attributes;
}
```

Customizing delete animations

What they didn’t tell you

- override finalLayoutAttributesForDisappearingItemAtIndexPath:
- gets called for every item that needs to be moved too, so need to track index of deleted item(s).
- do that in prepareForCollectionViewUpdates: (don’t forget to call super!)

```
- (void)prepareForCollectionViewUpdates:(NSArray *)updateItems
{
    [super prepareForCollectionViewUpdates:updateItems];

    self.deleteIndexPaths = [NSMutableArray array];
    for (UICollectionViewUpdateItem *update in updateItems)
    {
        if (update.updateAction == UICollectionUpdateActionDelete)
        {
            [self.deleteIndexPaths addObject:update.indexPathBeforeUpdate];
        }
    }
}
```

Customizing delete animations

What they didn’t tell you

- override finalLayoutAttributesForDisappearingItemAtIndexPath:
- gets called for every item that needs to be moved too, so need to track index of deleted item(s).
- do that in prepareForCollectionViewUpdates: (don’t forget to call super!)
- clean up in finalizeCollectionViewUpdates

```
- (void)finalizeCollectionViewUpdates
{
    [super finalizeCollectionViewUpdates];
    self.deleteIndexPaths = nil;
}
```

Customizing delete animations

What they didn't tell you

- override finalLayoutAttributesForDisappearingItemAtIndexPath:

```
- (UICollectionViewLayoutAttributes *)finalLayoutAttributesForDisappearingItemAtIndexPath:
    (NSIndexPath *)itemIndexPath
{
    if ([self.deleteIndexPaths containsObject:itemIndexPath])
    {
        UICollectionViewLayoutAttributes* attributes = [self
            layoutAttributesForItemAtIndexPath:itemIndexPath];

        // Configure attributes ...

        return attributes;
    }

    return nil;
}
```

Customizing delete animations

But wait, there's more!

- same applies to initialLayoutAttributesForAppearingItemAtIndexPath:
- will get called for both insert and delete animations
- must call super

```
- (UICollectionViewLayoutAttributes *)initialLayoutAttributesForAppearingItemAtIndexPath:
    (NSIndexPath *)itemIndexPath
{
    UICollectionViewLayoutAttributes *attributes = [super
        initialLayoutAttributesForAppearingItemAtIndexPath:itemIndexPath];

    if ([self.insertIndexPaths containsObject:itemIndexPath])
    {
        if (!attributes)
            attributes = [self layoutAttributesForItemAtIndexPath:itemIndexPath];

        // Configure attributes ...
    }

    return attributes;
}
```

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Custom delete animation

Summary

Summary

- Collection views are very powerful, flexible tool
- UICollectionViewFlowLayout is highly customizable via properties, subclassing, or delegation
- UICollectionView can support any arbitrary layout
- If you can dream it, build a layout for it!

Support for iOS 4.3 & 5

PSTCollectionView

- GitHub project by Peter Steinberger
- uses UICollectionView classes under iOS 6
- uses custom classes under iOS 4.3 and 5
- doesn’t have all the animations (yet)
- github.com/steipete/PSTCollectionView

Resources

- github.com/mpospese/IntroducingCollectionViews
- github.com/steipete/PSTCollectionView
- developer.apple.com/library/ios/documentation/WindowsViews/Conceptual/CollectionViewPGforIOS/CollectionViewPGforIOS.pdf
- WWDC 2012, Session 205 (Introducing Collection Views)
- WWDC 2012, Session 219 (Advanced Collection Views and Building Custom Layouts)

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