Advanced User Interfaces with Collection Views
An iTunes Connect case study

Session 232
Jeff Watkins
iOS Software Engineer
Introduction

New designs for iTunes Connect
Introduction

New designs for iTunes Connect
Pay off technical debt
Introduction

New designs for iTunes Connect
Pay off technical debt
Create modern architecture
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New designs for iTunes Connect
Pay off technical debt
Create modern architecture

Sample code: AdvancedCollectionView-1.0
Our Requirements

Complex data sources
Single loading indicator
Looked like UITableView
Multiple columns on iPad
Global headers
Pinning headers
Swipe to edit
Batch edit
Drag reordering
Our Requirements

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Data Sources
Minimizing complexity
Ghost Stories
Coldplay

Downton Abbey, Season 4
Downton Abbey

WWDC
iOS

Status
Available

Information
Apple ID 829909653
UPC/EAN/ISBN 825646299133
Label Parlophone UK
Artist(Artist Role) Coldplay (Primary), Coldplay (...)
Genre Alternative
Release Date May 19, 2014

Content
Songs 9

Description
From Masterpiece on PBS. Writer and creator Julian

Version Information
App Name WWDC
Apple ID 640199958
Primary Category Reference
Keywords WWDC, WWDC 2014, WWDC 2014 Apple Inc.
Traditional Data Source

Implemented in UICollectionViewController
Either
• One gigantic controller
• One controller per content type

Doesn’t encourage code reuse for similar sections
Aggregate Data Source

Implement data sources as separate objects
Enables code reuse
Single view controller
Aggregate Data Source

AAPLDataSource
The base data source class

AAPLSegmentedDataSource
Multiple children; only one active at a time

AAPLComposedDataSource
Multiple children; all active at once

AAPLBasicDataSource
One section; items stored in an NSArray
Segmented Data Source

Details
Episodes
Reviews
Trends
Composed Data Source

Details
Episodes
Reviews
Trends

Status
Available

Territory
United States

Information
Apple ID: 752257193
Container ID: PBS_DOWNTONABBEEKY_SEASON_4
Rating: TV-PG
Premiere Date: January 5, 2014

Description
From Masterpiece on PBS. Writer and creator Julian

Trends  Products  Search  Settings
Composed Data Source

Details

• Status

Episodes

Reviews

Trends
Composed Data Source

Details
- Status
- Information

Episodes
Reviews
Trends
Composed Data Source

Details
• Status
• Information
• Description

Episodes
Reviews
Trends
Basic Data Source

Details
Episodes
Reviews
Trends
Composed Data Source

Details
Episodes
Reviews
Trends
Composed Data Source

Details
Episodes
Reviews
• Ratings
Trends
Composed Data Source

Details
Episodes
Reviews
  • Ratings
  • Reviews
Trends
Custom Data Source

Details
Episodes
Reviews
Trends
Custom Data Source

Details
Episodes
Reviews
Trends
  • Graph
Custom Data Source

Details
Episodes
Reviews
Trends
  • Graph
  • History
Single Loading Indicator
Single Loading Indicator

Data source responsible for loading
Single Loading Indicator

Data source responsible for loading

View controller starts fetch in -viewWillAppea:
Single Loading Indicator

Data source responsible for loading
View controller starts fetch in -viewWillAppea:
Use state machine
AAPLLoadableContentStateMachine

- Initial
- Loading Content
- Content Loaded
- No Content
- Refreshing Content
- Error
Bobcat
Bobcats live all over North America.

Caracal
The caracal is also known as the desert lynx.

Cheetah
The cheetah can run faster than any other land animal.

Geoffroy's Cat
The Geoffroy's cat is a wild cat native to southern and central Amazonia.

Jaguar
Jaguars enjoy a nice swim from time to time.

Leopard
The leopard is the smallest of the four big cats.

Lion
The male lion is easily recognised by its mane.

Lynx
Lynx have a short tail and characteristic tufts of black hair on their ears.

Margay
Also known as the tree ocelot. They live in S. America.

Mountain Lion
Like almost all cats, the mountain lion is a solitary animal.

Ocelot
The Ocelot is also known as the dwarf leopard.

Oncilla
No Cats

All the big cats are napping or roaming elsewhere. Please try again later.
Unable To Load Cats

A problem with the network prevented loading the available cats. Please, check your network settings.
Aggregate Data Sources

- Composed Data Source
  - Initial
- Ratings Data Source
  - Initial
- Reviews Data Source
  - Initial
Aggregate Data Sources

Composed Data Source

Ratings Data Source
Loading Content

Reviews Data Source
Loading Content
Aggregate Data Sources

GET http://example.com/ratings/
GET http://example.com/reviews/
Aggregate Data Sources

- Ratings Data Source
  - Content Loaded
- Reviews Data Source
  - Loading Content

GET http://example.com/ratings/
GET http://example.com/reviews/

Composed Data Source
  - Loading Content

200 OK
Aggregate Data Sources

- Ratings Data Source
  - Content Loaded

- Reviews Data Source
  - Loading Content

GET http://example.com/ratings/

Composed Data Source

Loading Content

GET http://example.com/reviews/

200 OK
Aggregate Data Sources

Ratings Data Source
Content Loaded

Reviews Data Source
Content Loaded

Composed Data Source
Loading Content

GET http://example.com/ratings/

GET http://example.com/reviews/

200 OK

Content Loaded

Loading Content
Aggregate Data Sources

Composed Data Source
  ^{…}
  Loading Content

Ratings Data Source
  Content Loaded

Reviews Data Source
  Content Loaded

GET http://example.com/ratings/
GET http://example.com/reviews/
200 OK
200 OK
200 OK
Aggregate Data Sources

Composed Data Source
- Content Loaded

Ratings Data Source
- Content Loaded

Reviews Data Source
- Content Loaded

[collectionView performBatchUpdates:^{

} completion:nil];
Aggregate Data Sources

Composed Data Source
  - Content Loaded

  Ratings Data Source
    - Content Loaded

  Reviews Data Source
    - Content Loaded

[collectionView performBatchUpdates:^{
  
  
  
  ^[...]

  ^[...]

} completion:nil];
Aggregate Data Sources

Recap

Reduce view controller complexity
Promotes code reuse
Isolates task specific logic
Enables unified loading indicator
Our Requirements

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Custom UICollectionViewLayout

Complete flexibility and power
Design Metrics

What information did we need?
• Per section?
• Per header and footer?

Where does it go?
<table>
<thead>
<tr>
<th>Big Cats</th>
<th>See All</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ocelot</strong></td>
<td></td>
</tr>
<tr>
<td>The Ocelot is also known as the dwarf leopard.</td>
<td></td>
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<tr>
<td><strong>Tiger</strong></td>
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<tr>
<td>The tiger is the largest of the cat species.</td>
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<tr>
<td><strong>Mountain Lion</strong></td>
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# Section Metrics

**Big Cats**

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Section Metrics

Big Cats

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Tiger
The tiger is the largest of the cat species.

Mountain Lion
Like almost all cats, the mountain lion is a solitary animal.
Section Metrics

Big Cats

- **Ocelot**
  The Ocelot is also known as the dwarf leopard.

- **Tiger**
  The tiger is the largest of the cat species.

- **Mountain Lion**
  Like almost all cats, the mountain lion is a solitary animal.

See All
## Section Metrics

The Ocelot is also known as the dwarf leopard.

The leopard is the smallest of the four big cats.

The tiger is the largest of the cat species.

Like almost all cats, the mountain lion is a solitary animal.

The male lion is easily recognized by its mane.

The cheetah can run faster than any other land animal.
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## Ocelot

The Ocelot is also known as the dwarf leopard.

## Tiger

The tiger is the largest of the cat species.

## Mountain Lion

Like almost all cats, the mountain lion is a solitary animal.
Custom Attributes

backgroundColor
selectedBackgroundColor
padding
pinnedHeader
Global Headers

NSIndexPath normally has two indexes

• Section
• Item
Global Headers

NSIndexPath normally has two indexes
  • Section
  • Item

NSIndexPath with only one index

[NSIndexPath indexPathWithIndex:0]
Global Headers

NSIndexPath normally has two indexes
  • Section
  • Item

NSIndexPath with only one index
  [NSIndexPath indexPathWithIndex:0]

Need to ensure code checks length of index paths
Build the Layout

if data source changed
    snapshot data source
if collection view width changed or data source changed
    regenerate layout attributes &
    special layout attributes
if collection view origin changed
    update special layout attributes
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Snapshot Metrics

- Segmented Data Source
- Composed Data Source
- Information Data Source
- Description Data Source

Status Data Source

Information

- Apple ID: 752257193
- Container ID: PBS_DOWNTONABBSEASON_4
- Rating: TV-PG
- Premiere Date: January 5, 2014

Description

From Masterpiece on PBS. Writer and creator Julian
Snapshot Metrics

Segmented Data Source

Composed Data Source

Information Data Source

Description Data Source

rowHeight = 44
backgroundColor = light-Grey

Section 0

Status Data Source

Data Source

Information
Snapshot Metrics

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rowHeight = 44
backgroundColor = lightGrey
Snapshot Metrics

Segmented Data Source

Composed Data Source

Information Data Source

Description Data Source

Status Data Source

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backgroundColor = lightGrey

Downton Abbey, Season 4
Downton Abbey

Status
2 Available

Territory
United States

Information
Apple ID: 752257193
Container ID: PBS_DOWNTONABBEY_SEASO...
Rating: TV-PG
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Rating TV-PG
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Description

From Masterpiece on PBS, Writer and creator Julian
Optional Layout Methods

Critical to getting our layout just right

- prepareLayout
- prepareForCollectionViewUpdates:
- targetContentOffsetForProposedContentOffset:
- initialLayoutAttributes* and finalLayoutAttributes*
Optional Layout Methods

Critical to getting our layout just right
- prepareLayout
- prepareForCollectionViewUpdates:
- targetContentOffsetForProposedContentOffset:
- initialLayoutAttributes* and -finalLayoutAttributes*
-prepareLayout

Old

New
-prepareForCollectionViewUpdates:

Old

Deletions

Insertions

New
-prepareForCollectionViewUpdates:

**Old**

**New**

- Deletions
- Insertions
-prepareForCollectionViewUpdates:

Old

Deletions

Insertions

New
-prepareForCollectionViewUpdates:

Old

Deletions

Insertions

New
Target Content Offset

-targetContentOffsetForProposedContentOffset:

Adjusts scroll offset
Used by layout to calculate
• Pinning offset
• Delta to prevent unwanted motion
Target Content Offset

-targetContentOffsetForProposedContentOffset:

Adjusts scroll offset
Used by layout to calculate
  • Pinning offset
  • Delta to prevent unwanted motion

Get this calculation correct—use it in many places
hamburger salami bacon tail ham pork belly. Short loin swine cow ham, venison porchetta beef ribs corned beef flank. Filet mignon ground round andouille tri-tip. Kevin andouille pastrami jerky ground round, sirloin ham hock.
After

ham hock ground round
bresaola meatloaf pig spare
ribs short ribs short loin beef
ribs kielbasa. Frankfurter
meatloaf short ribs shank
hamburger salami bacon tail
ham pork belly. Short loin
swine cow ham, venison
porchetta beef ribs corned
beef flank. Filet mignon
ground round andouille tri-
tip. Kevin andouille pastrami
jerky ground round, sirloin
ham hock.
Initial and Final Layout Attributes

-initialLayoutAttributes*: called if the view **will** be on screen after the update
-finalLayoutAttributes*: called if the view **was** on the screen before the update
Both methods will be called for a view that remains on screen
Simple once update information processed
-initialLayoutAttributesForAppearingItemAtIndexPath:

NSInteger section = indexPath.section;

AAPLCollctionViewGridLayoutAttributes *result =
    [self.indexPathToItemAttributes[indexPath] copy];

BOOL inserted = [self.insertedSections containsIndex:section] ||
    [self.insertedIndexPaths containsObject:indexPath];
BOOL reloaded = [self.reloadedSections containsIndex:section];

...
-initWithLayoutAttributesForAppearingItemAtIndexPath:

NSInteger section = indexPath.section;

AAPLCollectionViewGridLayoutAttributes *result =
    [self.indexPathToItemAttributes[indexPath] copy];

BOOL inserted = [self.insertedSections containsIndex:section] ||
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    [self.insertedIndexPaths containsObject:indexPath];
BOOL reloaded = [self.reloadedSections containsIndex:section];

...
if (inserted)
    result.alpha = 0;

if (reloaded && !self.oldIndexPathToItemAttributes[indexPath])
    result.alpha = 0;

results.frame = CGRectOffset(results.frame,
    -self.contentOffsetDelta.x, -self.contentOffsetDelta.y);
return results;
if (inserted)
    result.alpha = 0;

if (reloaded && !self.oldIndexPathToItemAttributes[indexPath])
    result.alpha = 0;

results.frame = CGRectOffset(results.frame,
    -self.contentOffsetDelta.x, -self.contentOffsetDelta.y);
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-initialLayoutAttributesForAppearingItemAtIndexPath:

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    -self.contentOffsetDelta.x, -self.contentOffsetDelta.y);
return results;
Book keeping is critical
Optional methods make a big difference
Our Requirements

Complex data sources
Single loading indicator
Looked like UITableView
Multiple columns on iPad
Global headers
Pinning headers
Swipe to edit
Batch edit
Drag reordering
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Swipe to Edit and Drag Reordering

Just a little something extra
Add AAPLAction instances to cells

NSString *favoriteTitle = NSLocalizedString(@“★”, @“Favorite action”);
NSString *deleteTitle = NSLocalizedString(@“Delete”, @“Delete action”);

cell.editActions = @[
    [AAPLAction actionWithTitle:favoriteTitle
        selector:@selector(makeFavorite:)],
    [AAPLAction destructiveActionWithTitle:deleteTitle
        selector:@selector(swipeToDeleteCell:)]
];
Additional Custom Attributes

columnIndex
editing
movable
### Ocelot
The Ocelot is also known as the dwarf leopard.

### Tiger
The tiger is the largest of the cat species.

### Mountain Lion
Like almost all cats, the mountain lion is a solitary animal.
<table>
<thead>
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<td></td>
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### Cat Species

<table>
<thead>
<tr>
<th>Species</th>
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<td>Leopard</td>
<td>The leopard is the smallest of the four big cats.</td>
</tr>
<tr>
<td>Lion</td>
<td>The male lion is easily recognized by its mane.</td>
</tr>
<tr>
<td>Cheetah</td>
<td>The cheetah can run faster than any other land animal.</td>
</tr>
<tr>
<td>Ocelot</td>
<td>Leopard</td>
</tr>
<tr>
<td>---------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>The Ocelot is also known as the dwarf leopard.</td>
<td>The leopard is the smallest of the four big cats.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tiger</th>
<th>Cheetah</th>
</tr>
</thead>
<tbody>
<tr>
<td>The tiger is the largest of the cat species.</td>
<td>The cheetah can run faster than any other land animal.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mountain Lion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Like almost all cats, the mountain lion is a solitary animal.</td>
</tr>
</tbody>
</table>
**Batch Editing**

<table>
<thead>
<tr>
<th>Animal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ocelot</strong></td>
<td>The Ocelot is also known as the dwarf leopard.</td>
</tr>
<tr>
<td><strong>Tiger</strong></td>
<td>The tiger is the largest of the cat species.</td>
</tr>
<tr>
<td><strong>Lion</strong></td>
<td>The male lion is easily recognized by its mane.</td>
</tr>
</tbody>
</table>
Batch Editing

- **Ocelot**: The Ocelot is also known as the dwarf leopard.
- **Tiger**: The tiger is the largest of the cat species.
- **Lion**: The male lion is easily recognized by its mane.

Editing = YES, Movable = YES
<table>
<thead>
<tr>
<th>Animal</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocelot</td>
<td>The Ocelot is also known as the dwarf leopard.</td>
</tr>
<tr>
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<tr>
<td>Lion</td>
<td>The male lion is easily recognized by its mane.</td>
</tr>
</tbody>
</table>
Ocelot
The Ocelot is also known as the dwarf leopard.

Lion
The male lion is easily recognized by its mane.
AAPLSwipeToEditStateMachine

Manages gesture recognizers
• UIPanGestureRecognizer
• UILongPressGestureRecognizer
States are somewhat complex
Works with our layout and cells
Drag to Reorder

Required layout changes
- Layout gap
- Hidden cells
- Fast layout calculation

Requires data source support
- Can move item at indexPath?
- May move item from indexPath to indexPath?
- Move item at indexPath to indexPath
Drag to Reorder

Required layout changes
• Layout gap
• Hidden cells
• Fast layout calculation

Requires data source support
• Can move item at indexPath?
• May move item from indexPath to indexPath?
• Move item at indexPath to indexPath
Our Requirements

- Complex data sources
- Single loading indicator
- Looked like UITableView
- Multiple columns on iPad
- Global headers
- Pinning headers
- Swipe to edit
- Batch edit
- Drag reordering
Summary

Aggregate data sources simplify complex designs
Proper bookkeeping makes UICollectionViewLayout easy
Swipe to Edit and Drag Reordering are incremental additions
More Information

Jake Behrens
App Frameworks Evangelist
behrens@apple.com

Documentation
Collection View Programming Guide for iOS
http://developer.apple.com/ios

Apple Developer Forums
http://devforums.apple.com
<table>
<thead>
<tr>
<th>Related Sessions</th>
</tr>
</thead>
<tbody>
<tr>
<td>• What's New in Table and Collection Views</td>
</tr>
<tr>
<td>Labs</td>
</tr>
<tr>
<td>-------------------------------</td>
</tr>
<tr>
<td>• Table View and Collection View Lab</td>
</tr>
</tbody>
</table>