

#WWDC18

Practical Approaches to Great App Performance

Session 407

Jon Hess, Xcode Engineer

Matthieu Lucas, Photos Engineer

Approaching Performance

A framework for getting started

Jon Hess, Xcode Engineer



Measure

Fixing Bugs

Reproduce

Debug

Modify

Repeat

Fixing ~~Bugs~~ Performance

Reproduce

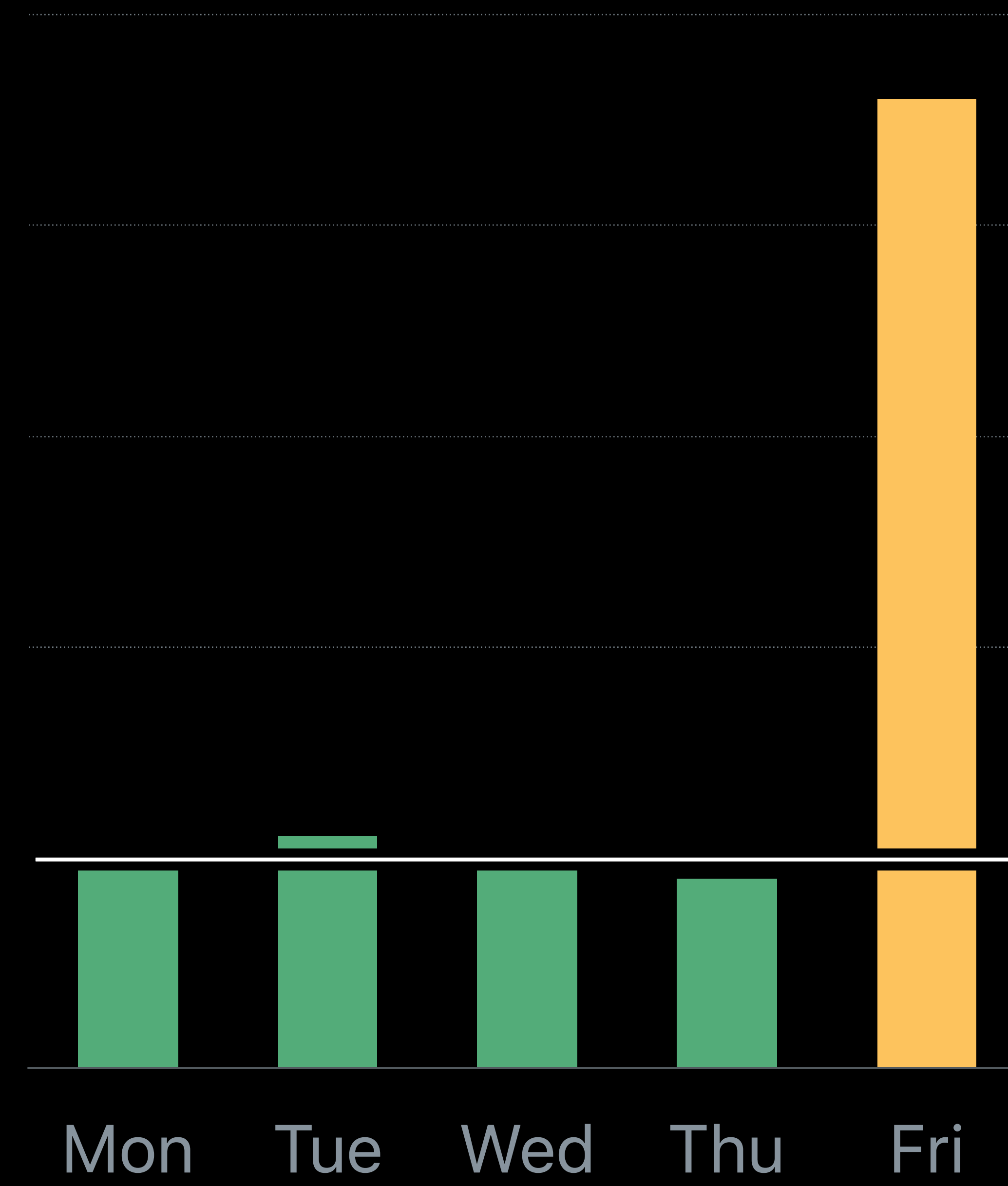
~~Debug~~ Profile

Modify

Repeat

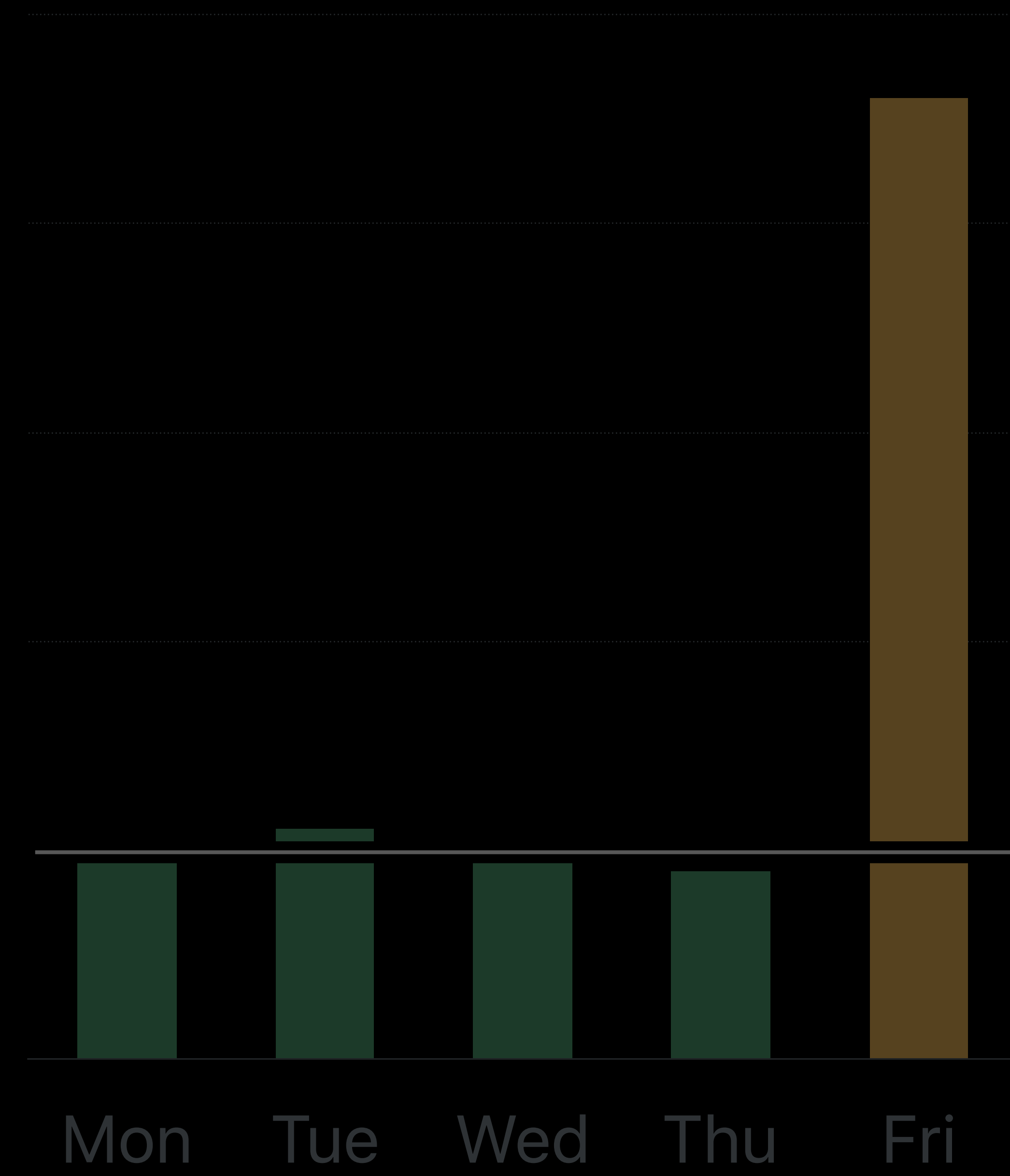
Types of Performance Work

Types of Performance Work

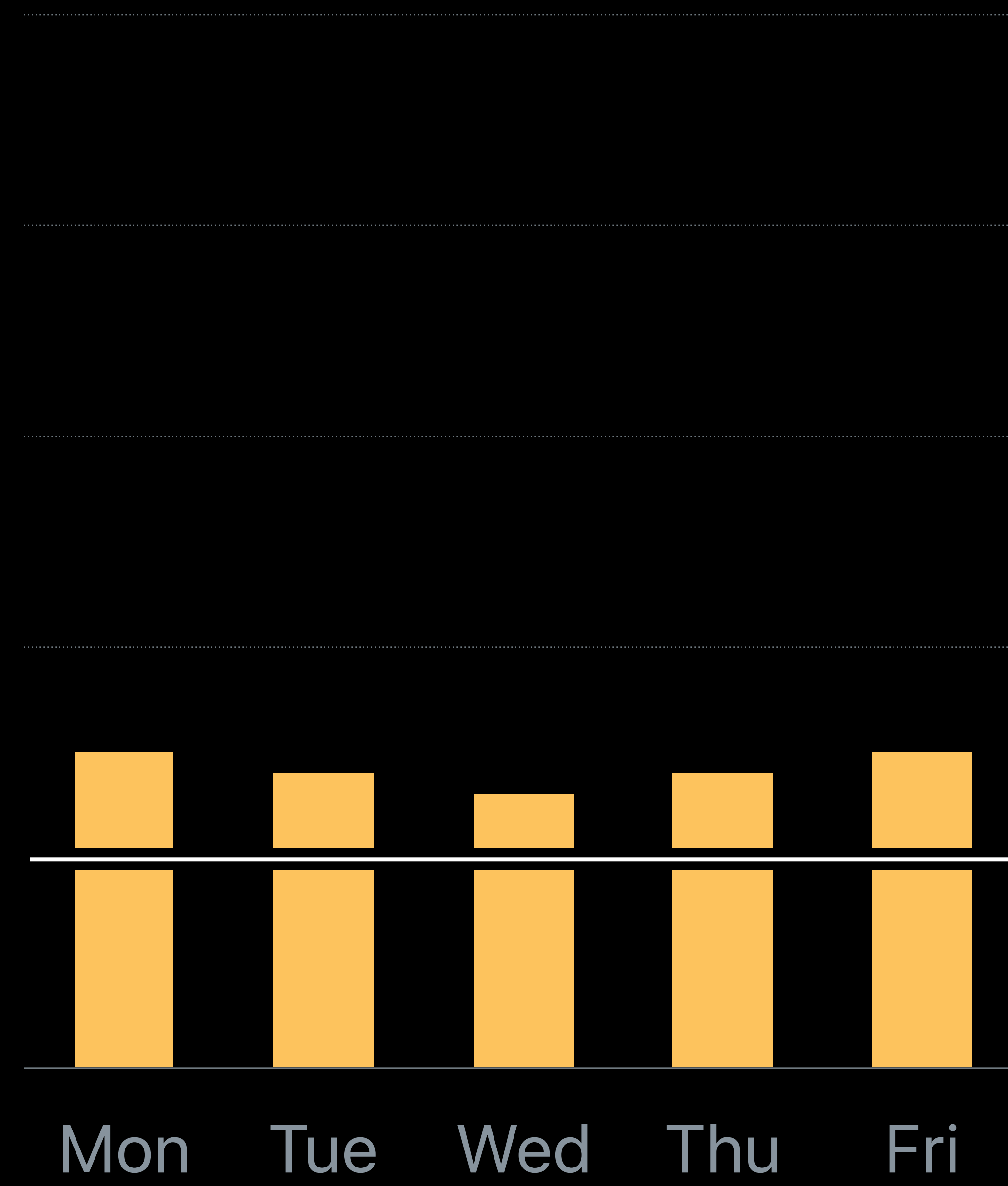


Major Regression

Types of Performance Work

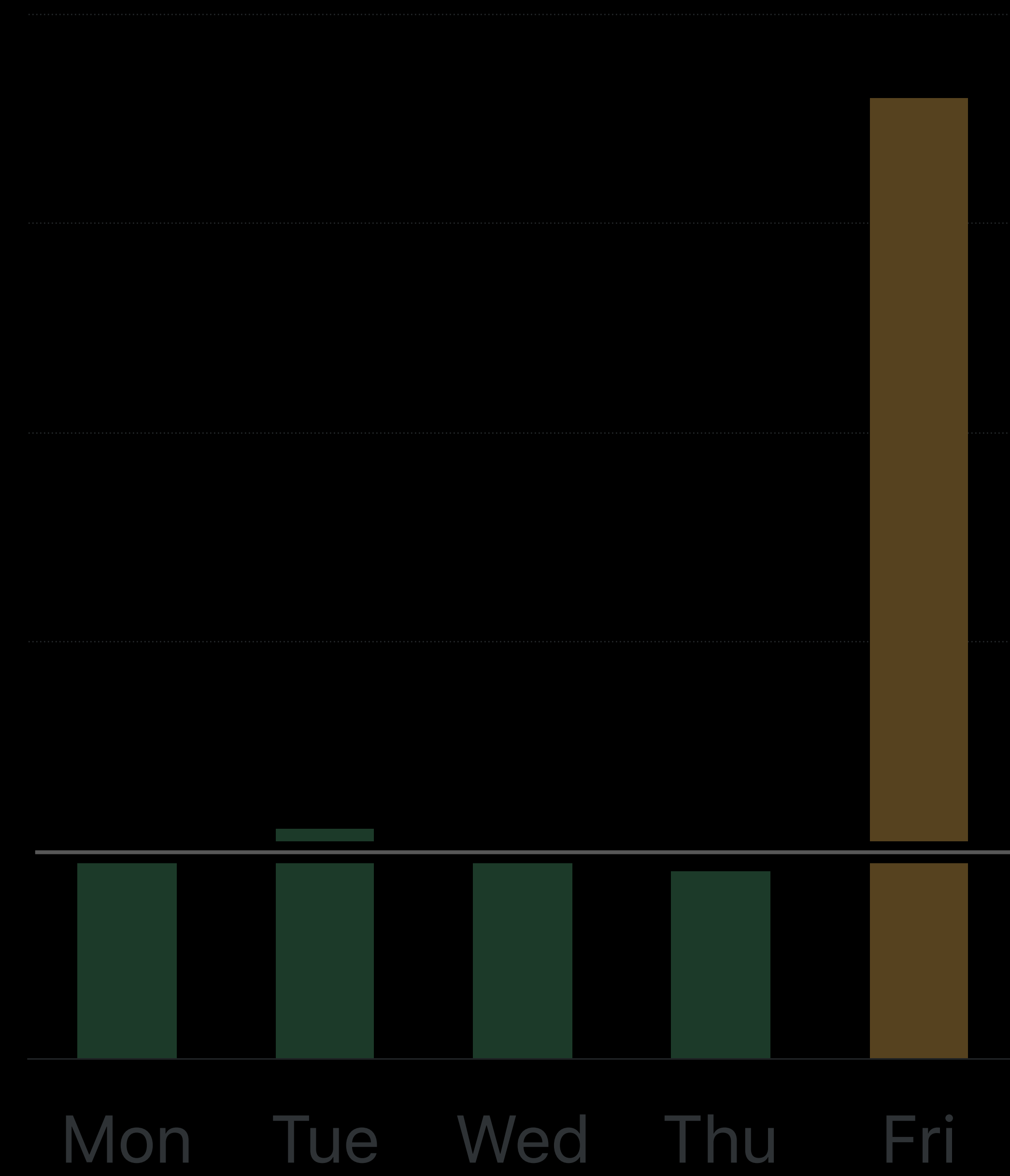


Major Regression

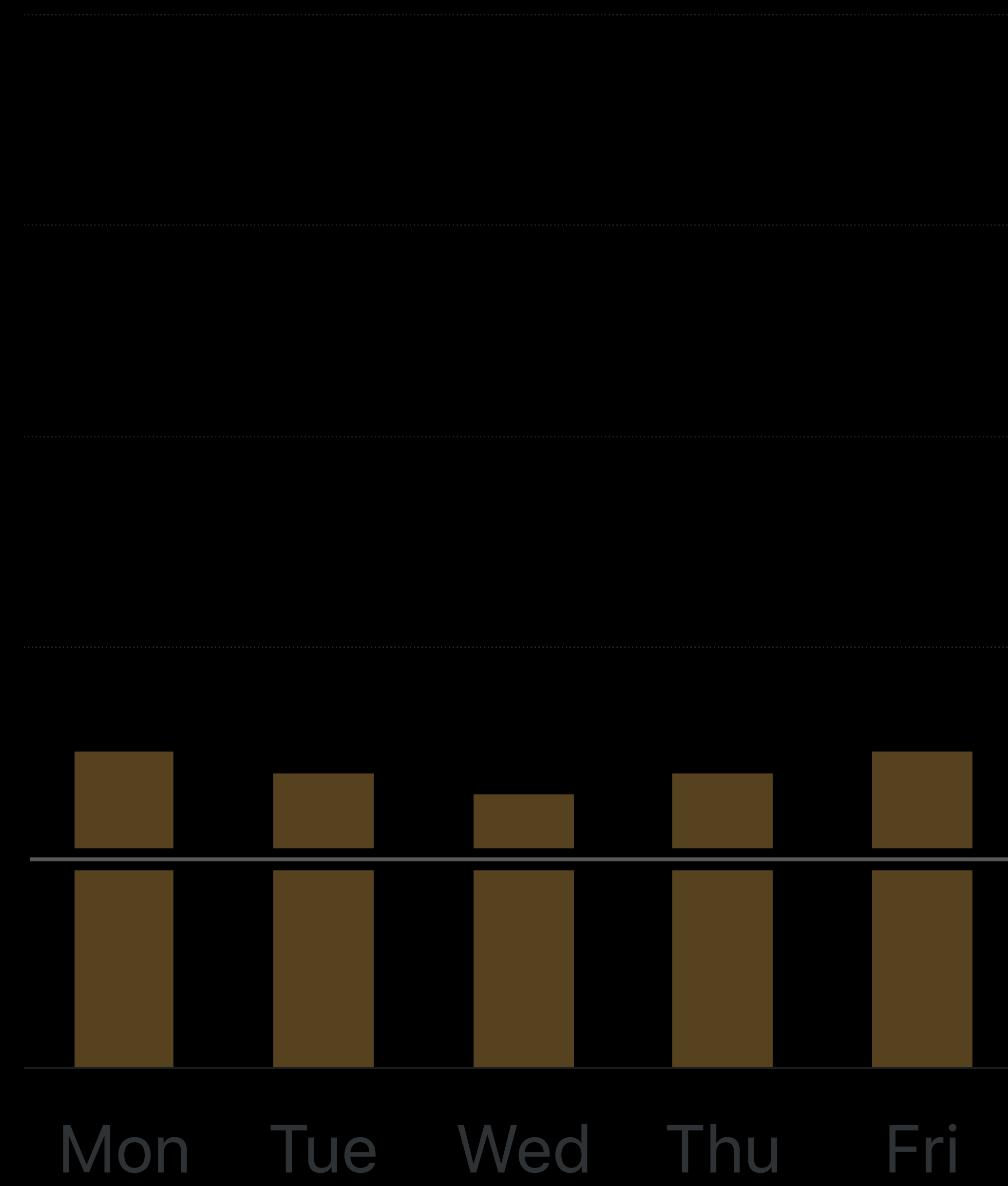


Off Target

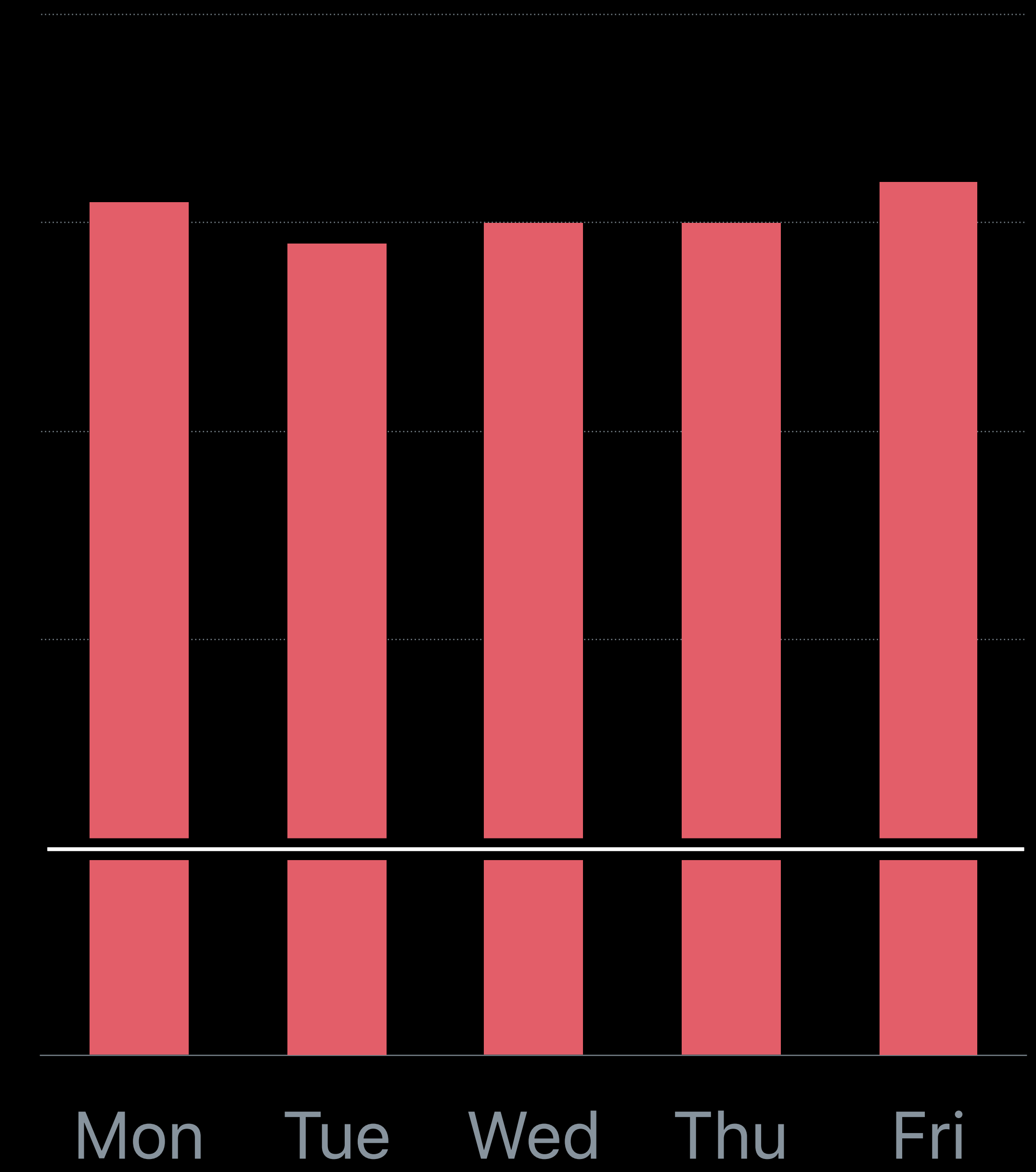
Types of Performance Work



Major Regression

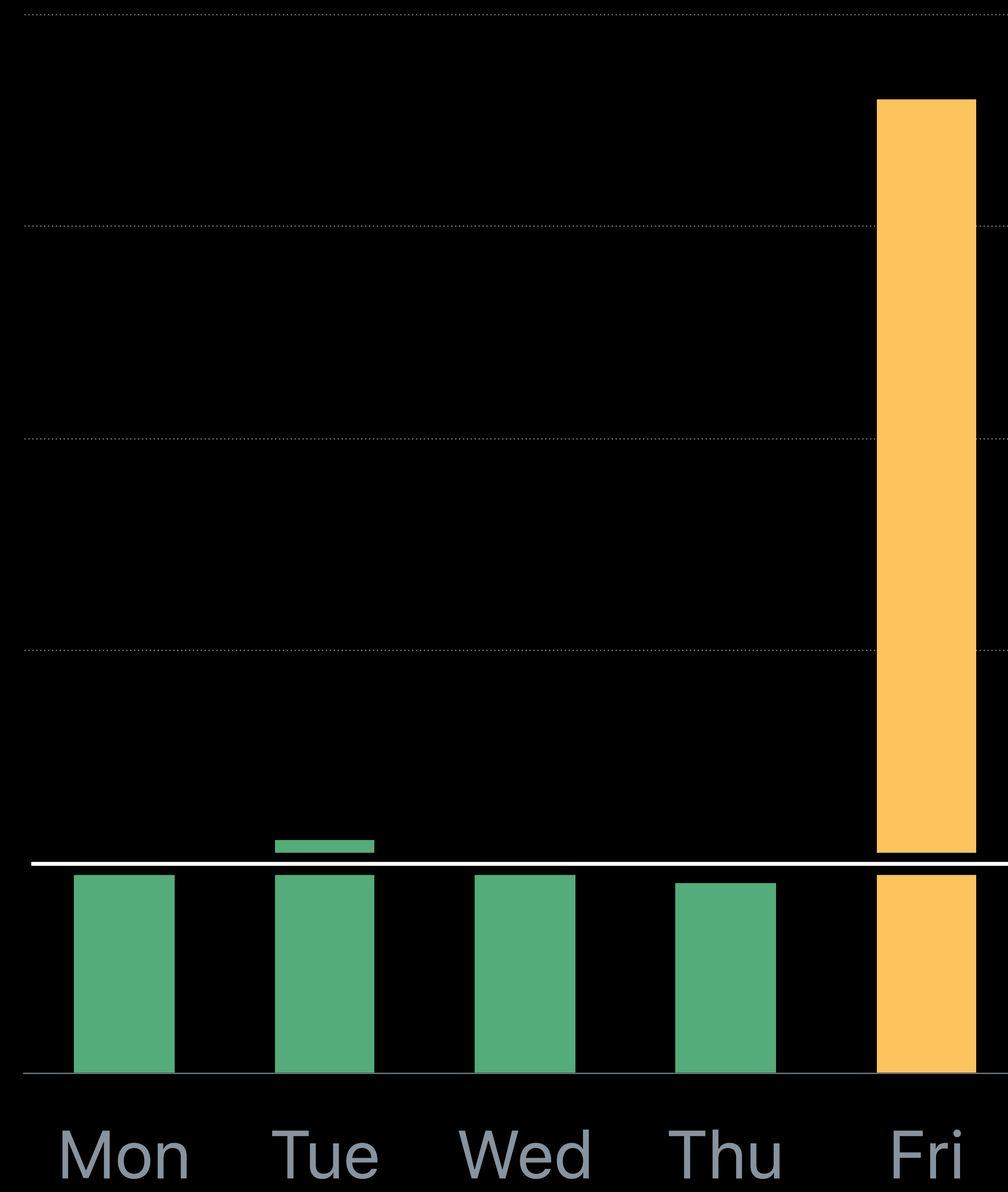


Off Target

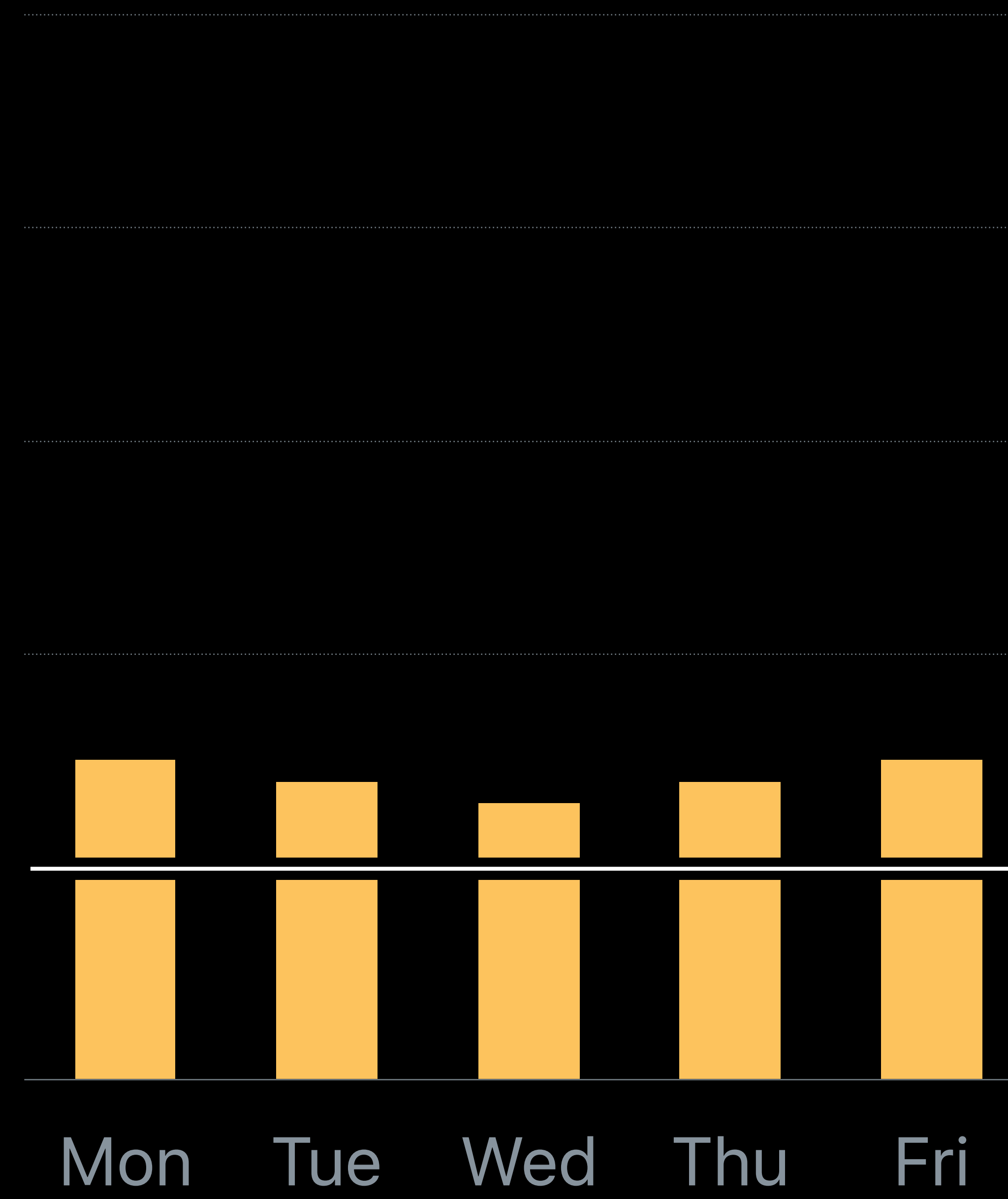


Poor Design

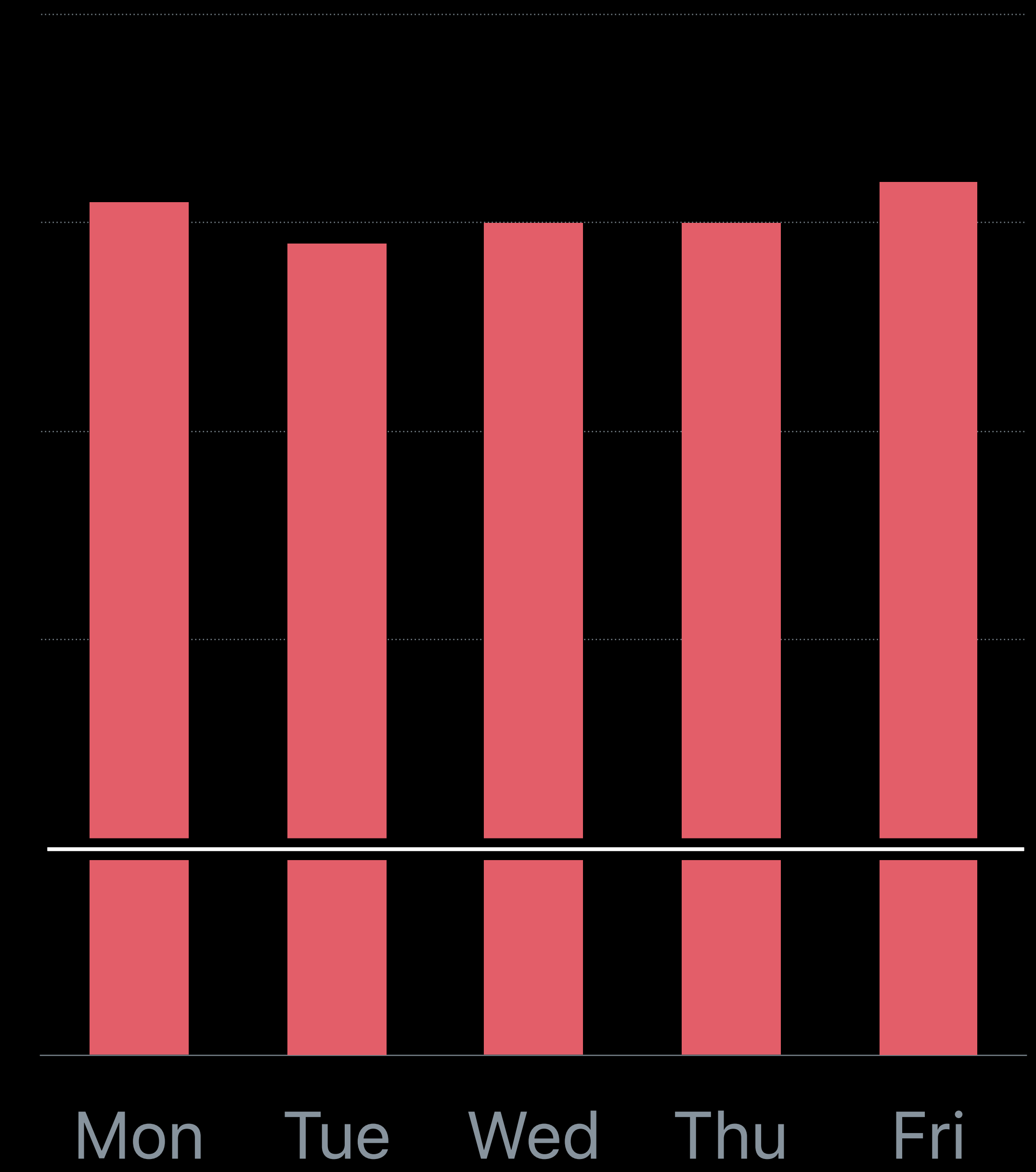
Types of Performance Work



Major Regression



Off Target



Poor Design



Test



Unit



Integration

Unit Tests

Focused benchmarks

Isolate issues

Pinpoints regressions



Integration Tests

Measures user experience

Measures dependencies

Measures side effects





Profile

Demo

Introduction to profiling

Common Solutions

Common Solutions

Defer

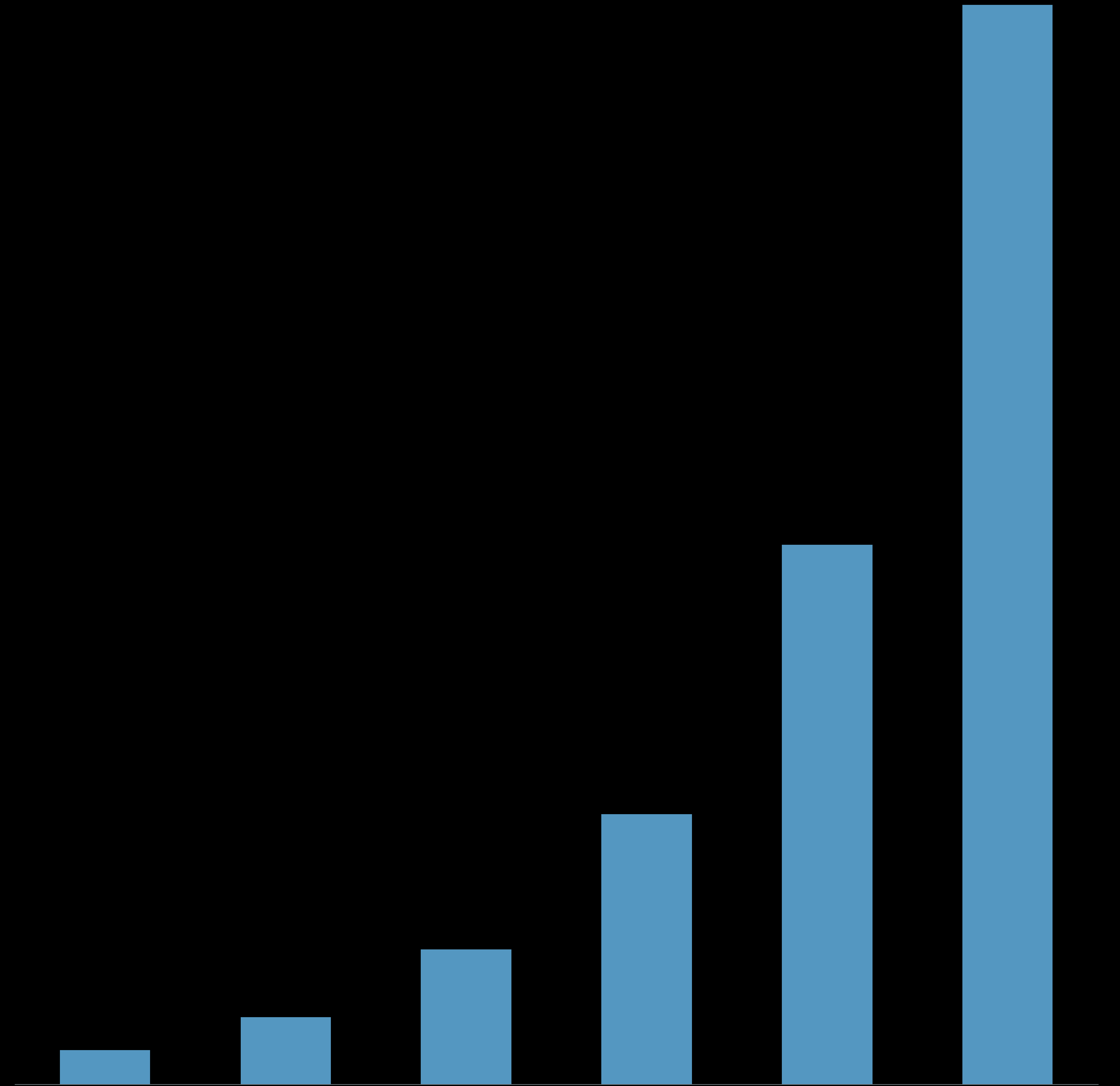
Batch

Share results

Fewer views

Direct observation

Prefer records to dictionaries



Designing for Performance

Practical examples from Photos

Matthieu Lucas, Photos Engineer

9:41



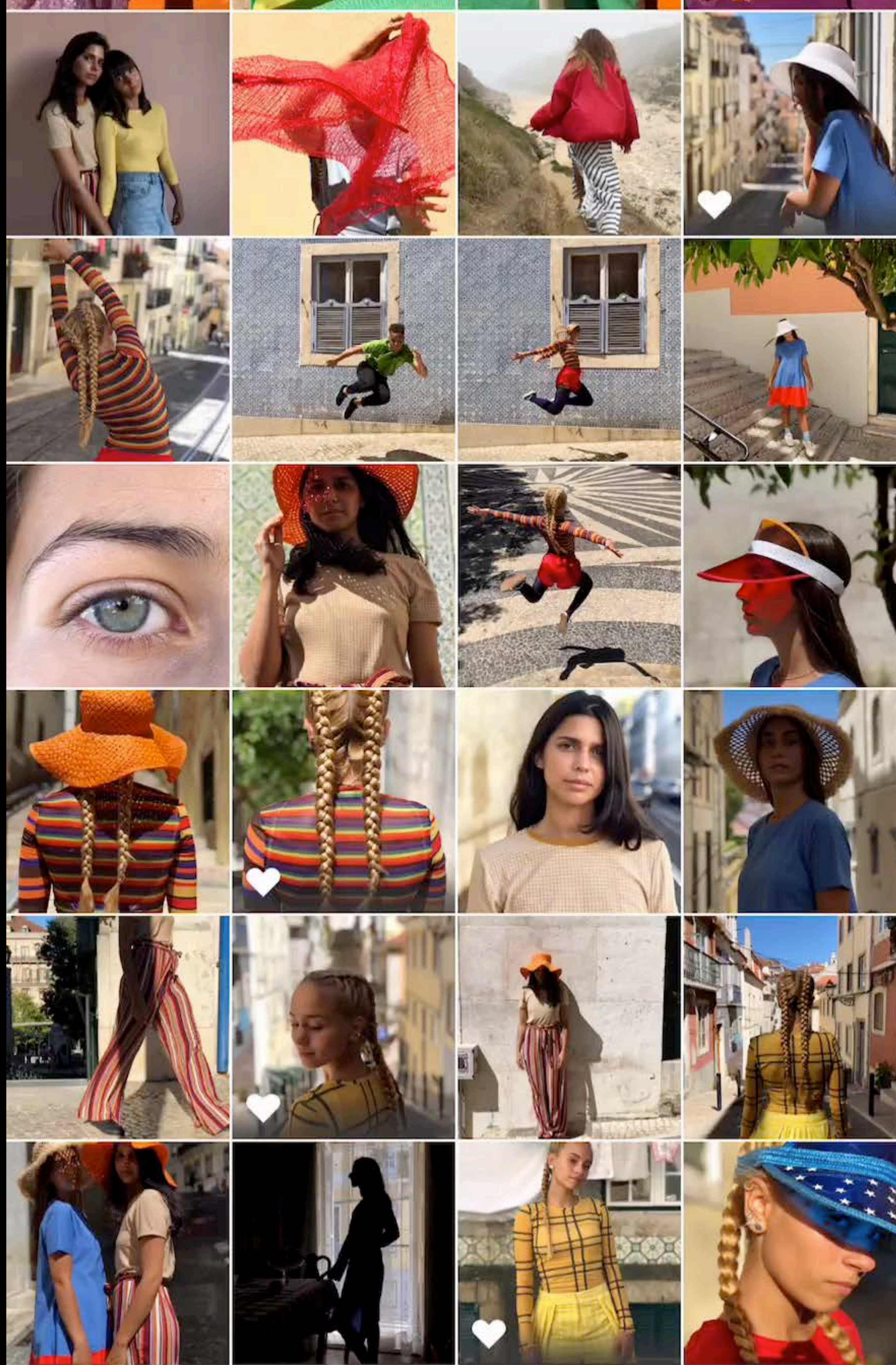
< Collections

Moments

Select

Lisbon

Aug 21, 2017 · Lisbon



Photos



For You



Albums



Search

9:41



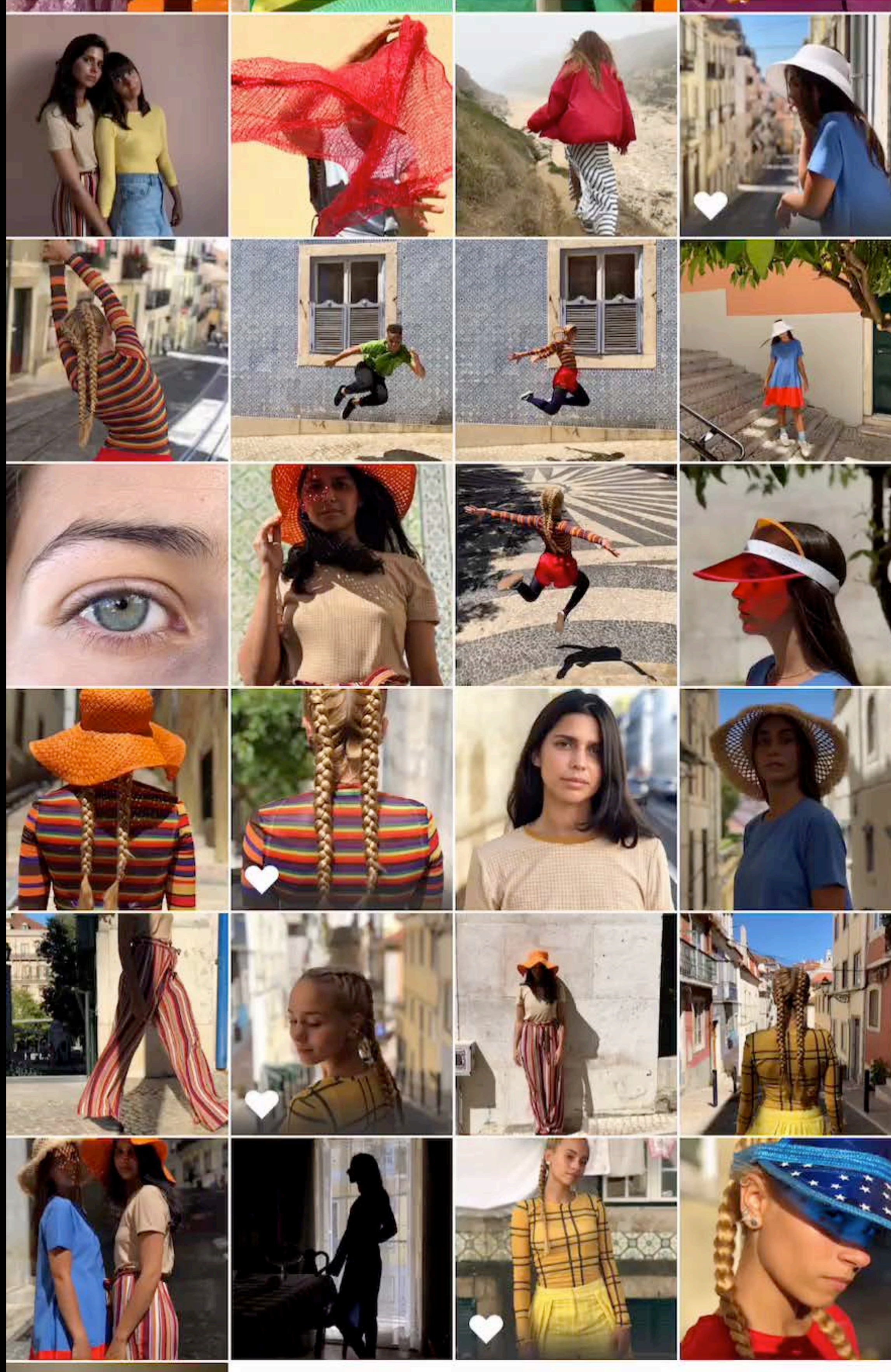
< Collections

Moments

Select

Lisbon

Aug 21, 2017 · Lisbon



Photos



For You



Albums



Search

9:41



< Years

Collections

Nashville

May 6–11, 2017 · Tennessee



Marrakech Médina

Aug 6, 2017 · Marrakech-Tensift-Al Haouz



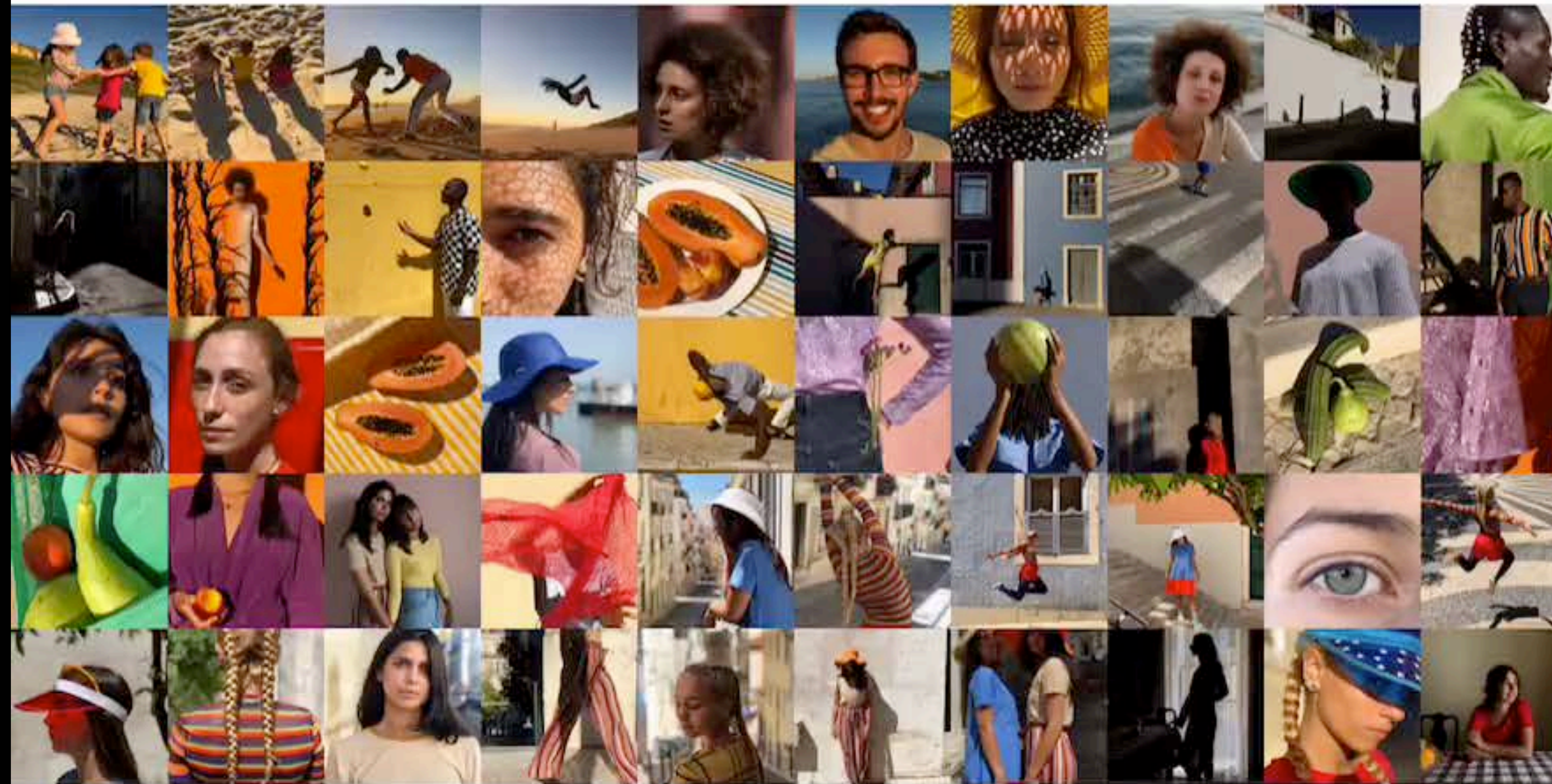
Essaouira

Aug 7, 2017 · Marrakech-Tensift-Al Haouz



Lisbon

Aug 19–21, 2017 · Lisbon



Photos



For You



Albums



Search

9:41



< Years

Collections

Nashville

May 6–11, 2017 · Tennessee



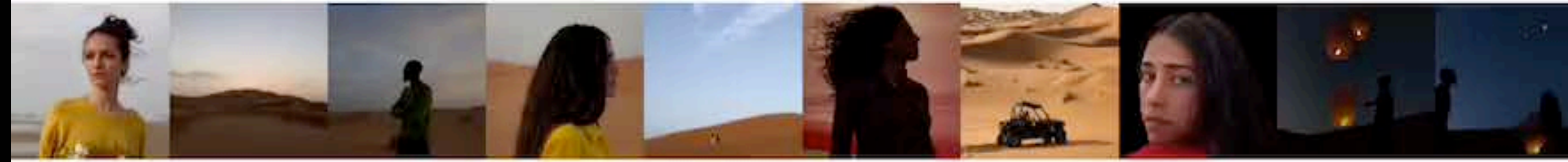
Marrakech Médina

Aug 6, 2017 · Marrakech-Tensift-Al Haouz



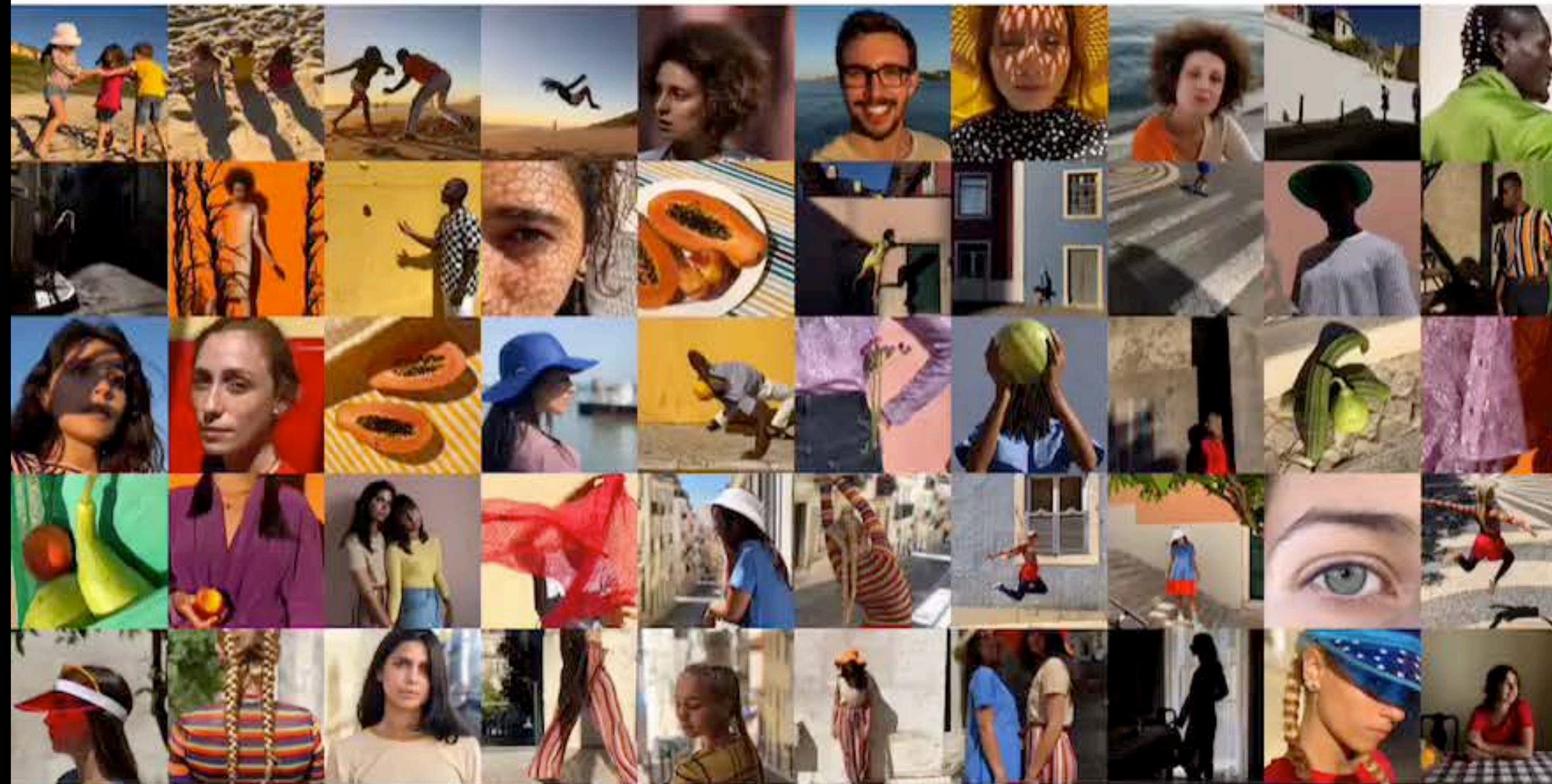
Essaouira

Aug 7, 2017 · Marrakech-Tensift-Al Haouz



Lisbon

Aug 19–21, 2017 · Lisbon



Photos



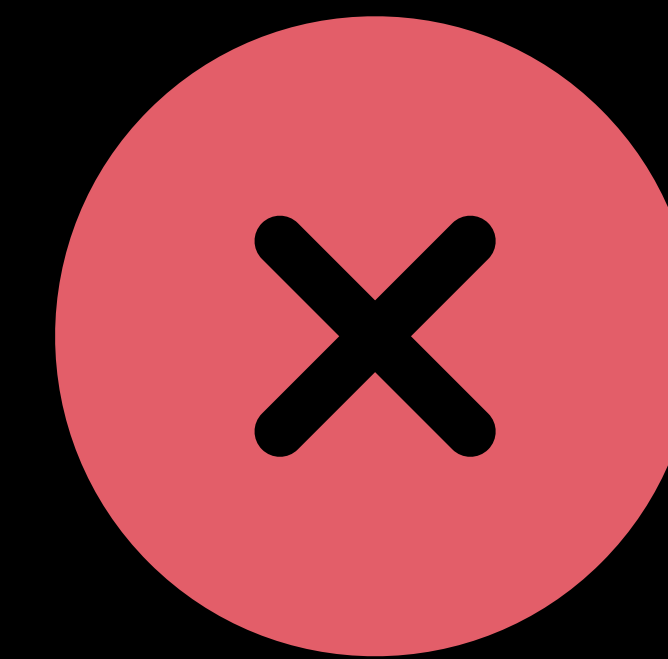
For You

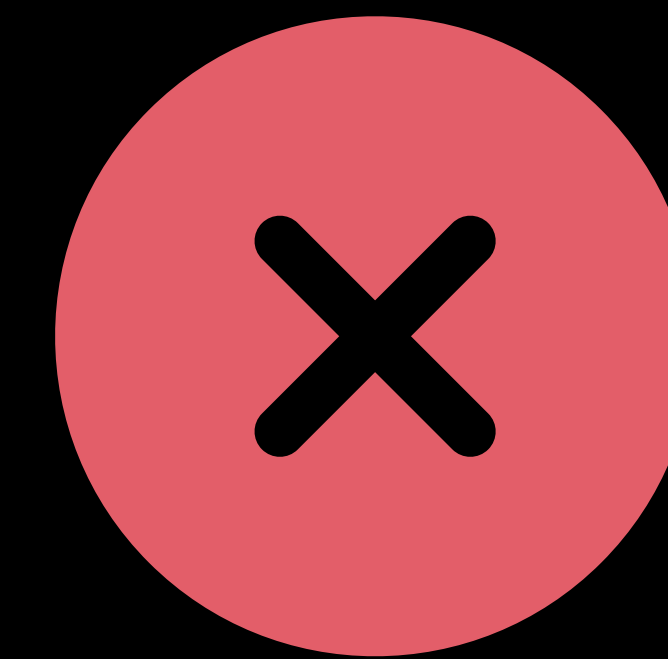


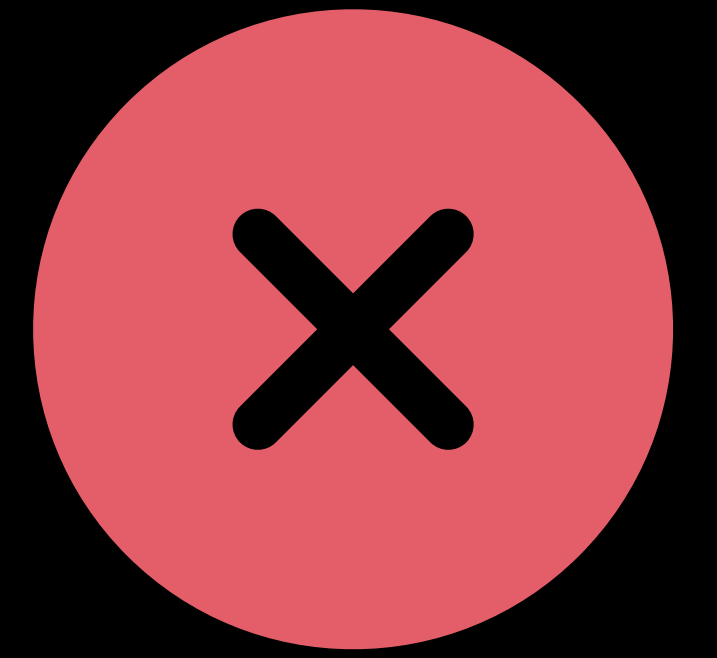
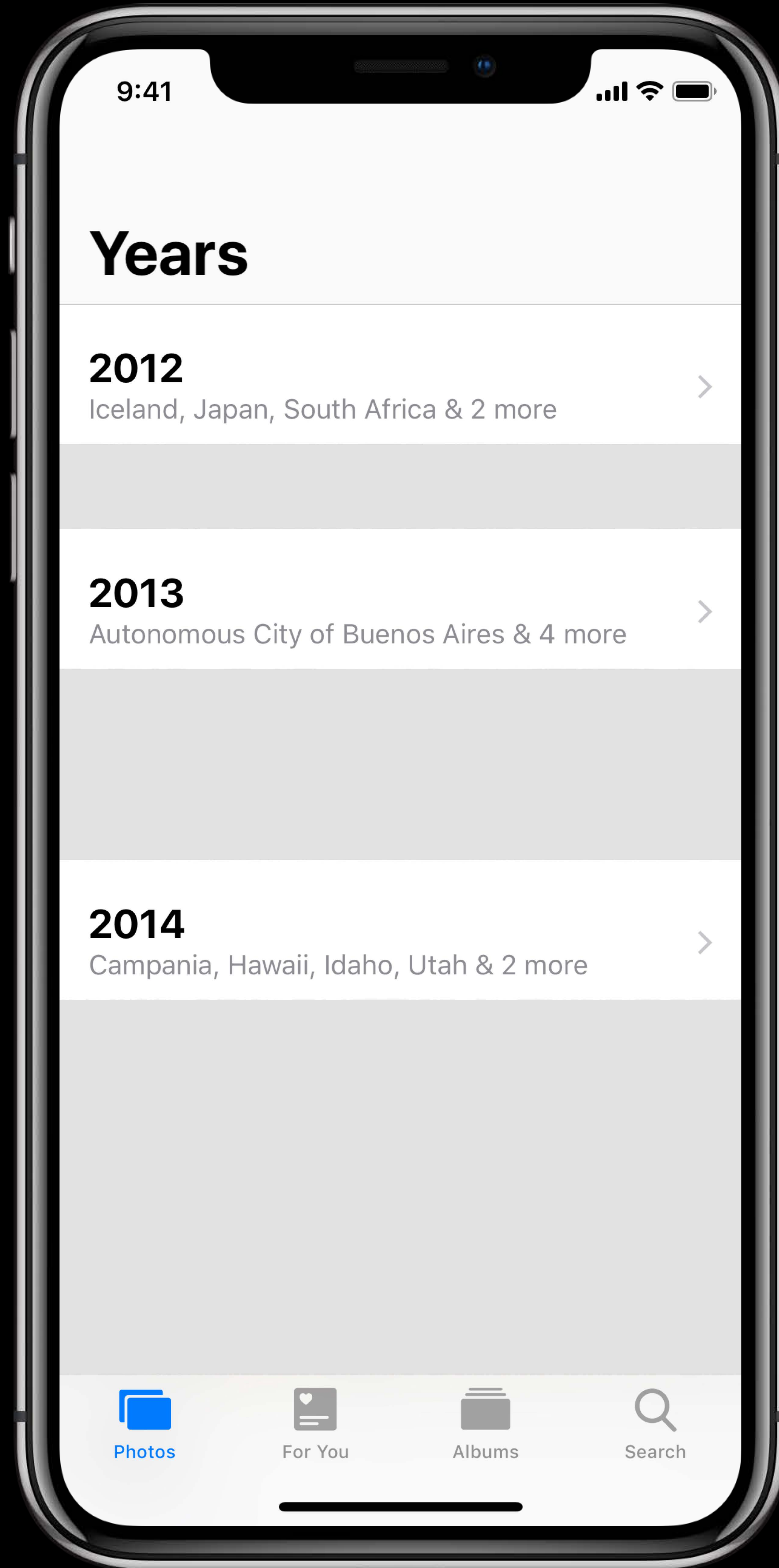
Albums



Search







Not a great user experience

Responsiveness

Smooth animations

Great user experience

Launching to Moments

Building Collections/Years

Launching to Moments

Building Collections/Years

Launching to Moments

What is launch?

Launching to Moments

What is launch?



Cold

Launching to Moments

What is launch?



Cold



Warm

Launching to Moments

What is launch?



Cold



Warm



Hot

Launching to Moments

What is launch?



Cold



Warm



Hot

Launching to Moments

Measuring launch

Time it takes from the moment you hit the application's icon until you can start interacting with the application

Launching to Moments

Measuring launch

Time it takes from the moment you hit the application's icon until you can start ~~interacting with~~ **using** the application

Launching to Moments

Goals

Launching to Moments

Goals

Instant

Launching to Moments

Goals

Instant

No spinner

Launching to Moments

Goals

Instant

No spinner

No placeholders

Launching to Moments

Goals

Launching to Moments

Goals

Instant?

Launching to Moments

Goals

Instant?

- Same time as the zoom animation from the home screen

Launching to Moments

Goals

Instant?

- Same time as the zoom animation from the home screen
- Between 500 and 600 milliseconds

Launching to Moments

Goals

Instant?

- Same time as the zoom animation from the home screen
- Between 500 and 600 milliseconds
- Seamless transition



9:41



FaceTime



Calendar



Photos



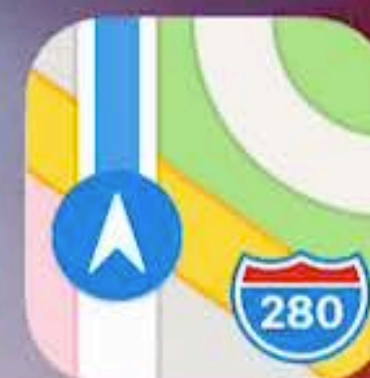
Camera



Mail



Clock



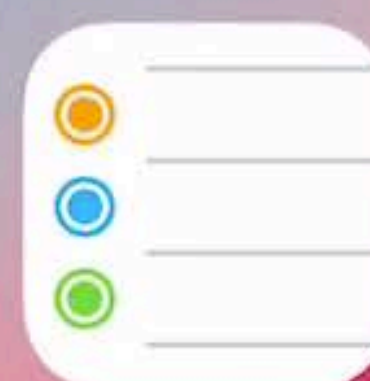
Maps



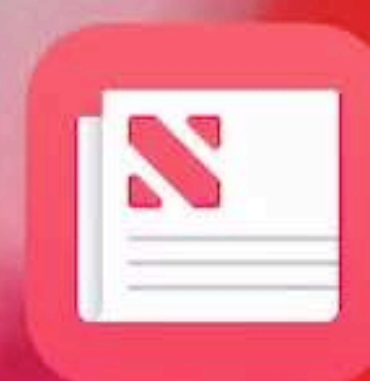
Weather



Notes



Reminders



News



Stocks



TV



iTunes Store



App Store



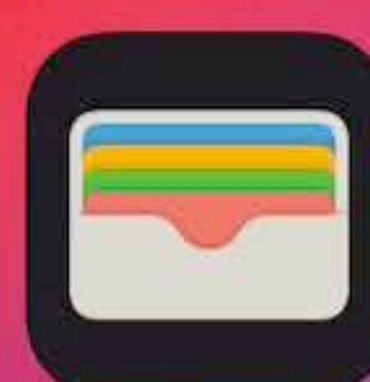
Books



Health



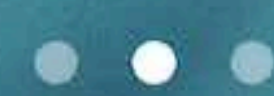
Home



Wallet



Settings





9:41



FaceTime



Calendar



Photos



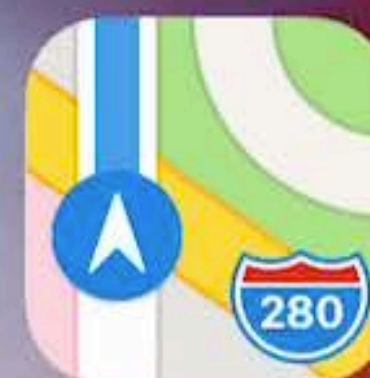
Camera



Mail



Clock



Maps



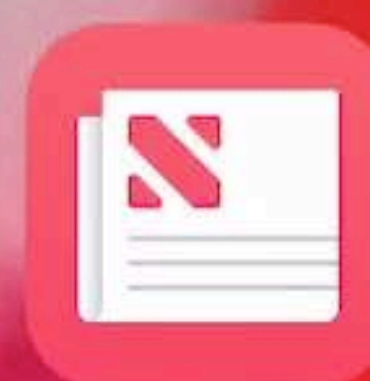
Weather



Notes



Reminders



News



Stocks



TV



iTunes Store



App Store



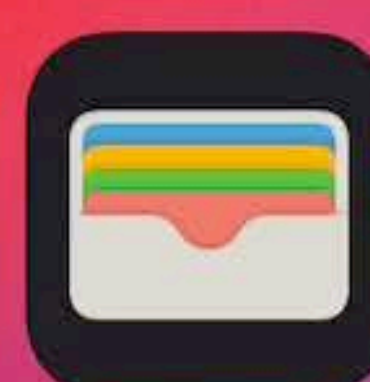
Books



Health



Home



Wallet



Settings





9:41



FaceTime



Calendar



Photos



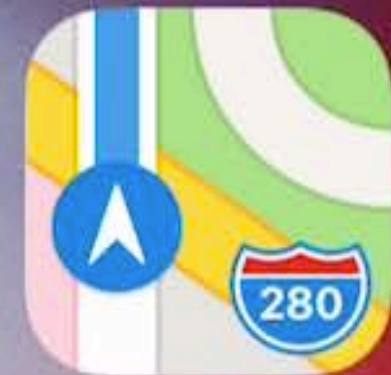
Camera



Mail



Clock



Maps



Weather



Notes



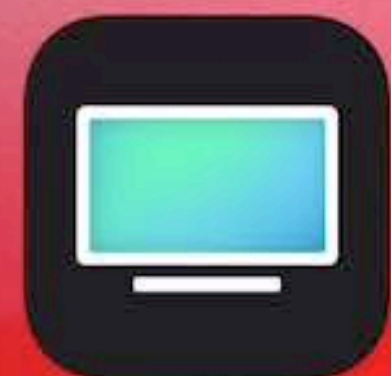
Reminders



News



Stocks



TV



iTunes Store



App Store



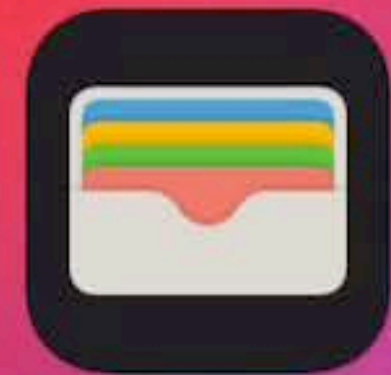
Books



Health



Home



Wallet



Settings





9:41



FaceTime



Calendar



Photos



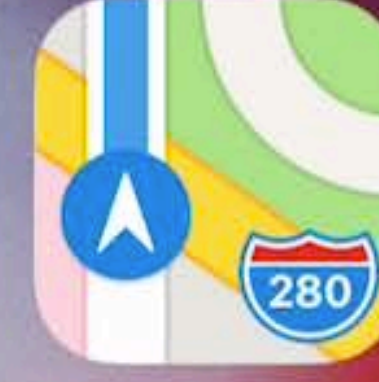
Camera



Mail



Clock



Maps



Weather



Notes



Reminders



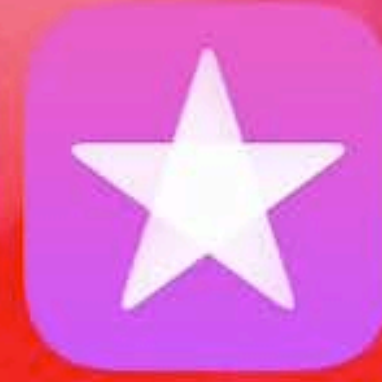
News



Stocks



TV



iTunes Store



App Store



Books



Health



Home



Wallet

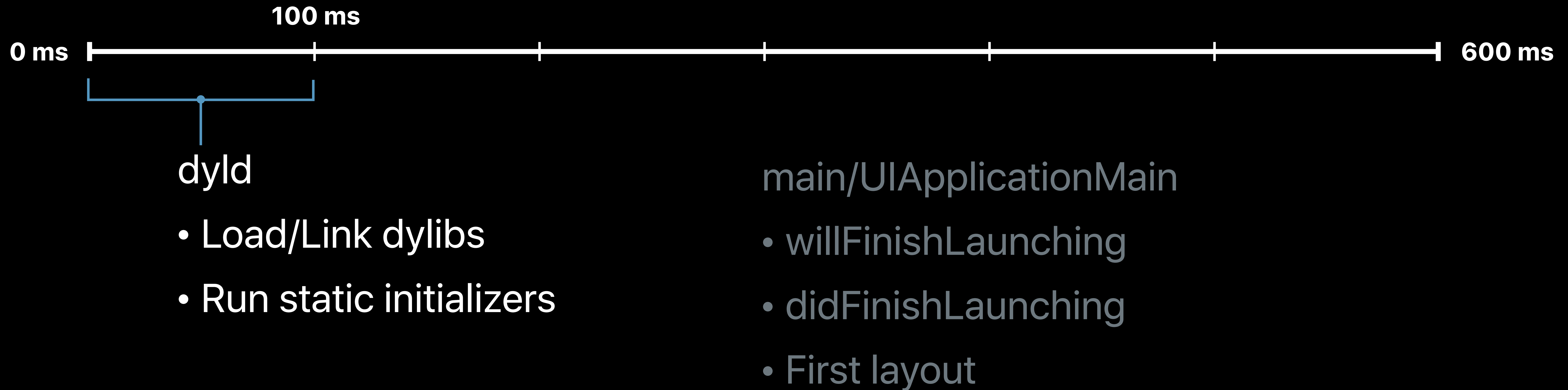


Settings



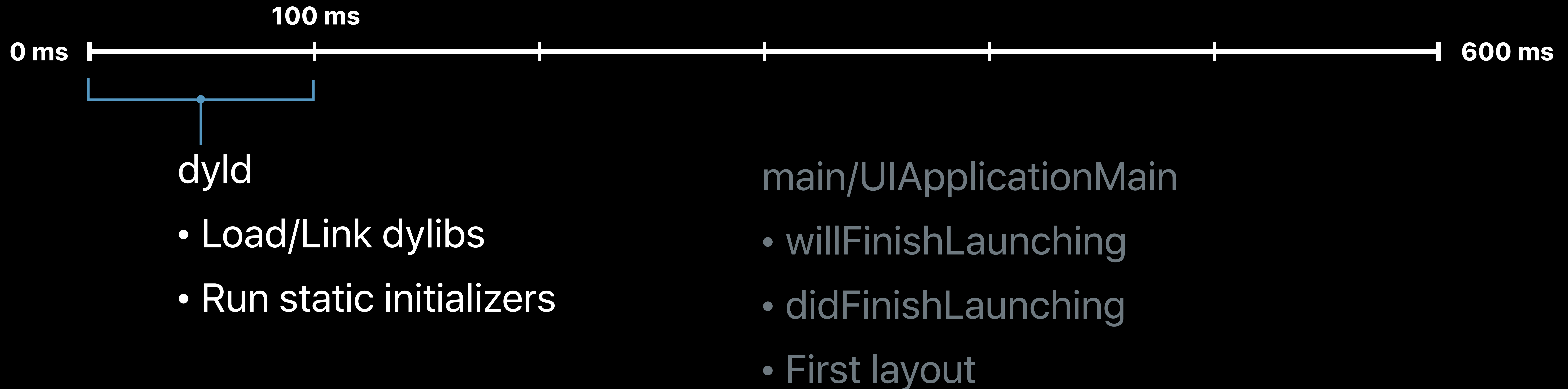
Launching to Moments

Anatomy



Launching to Moments

Anatomy



Launching to Moments

Anatomy



Launching to Moments

Principles

Launching to Moments

Principles

Be lazy

Launching to Moments

Principles

Be lazy

Be proactive

Launching to Moments

Principles

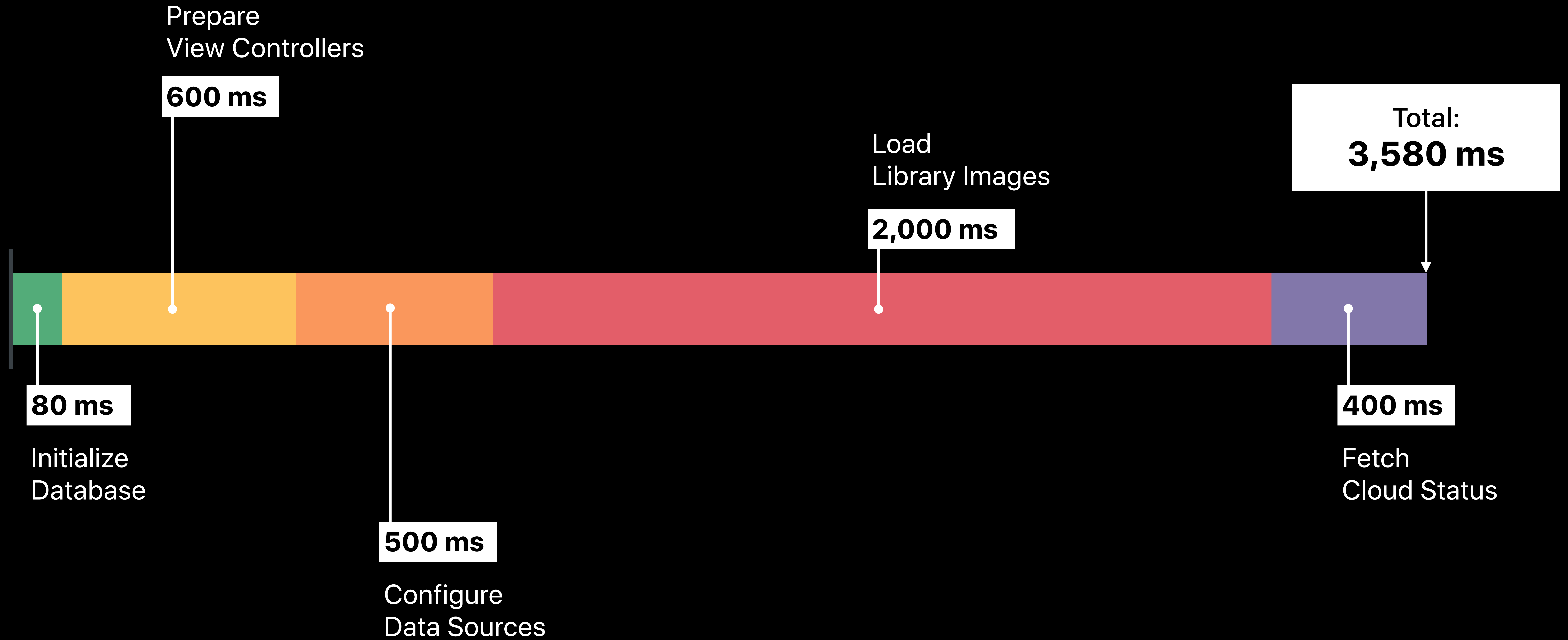
Be lazy

Be proactive

Be constant

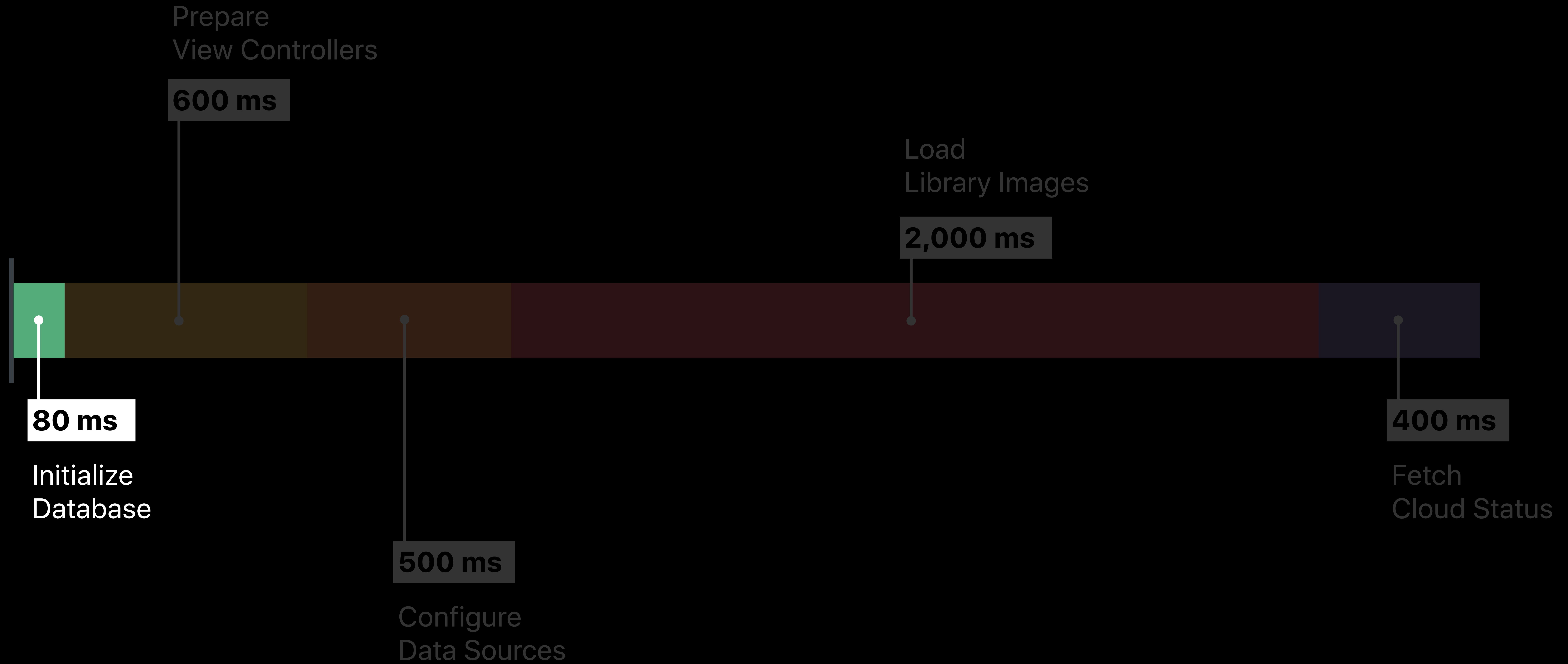
Launching to Moments

Breakdown



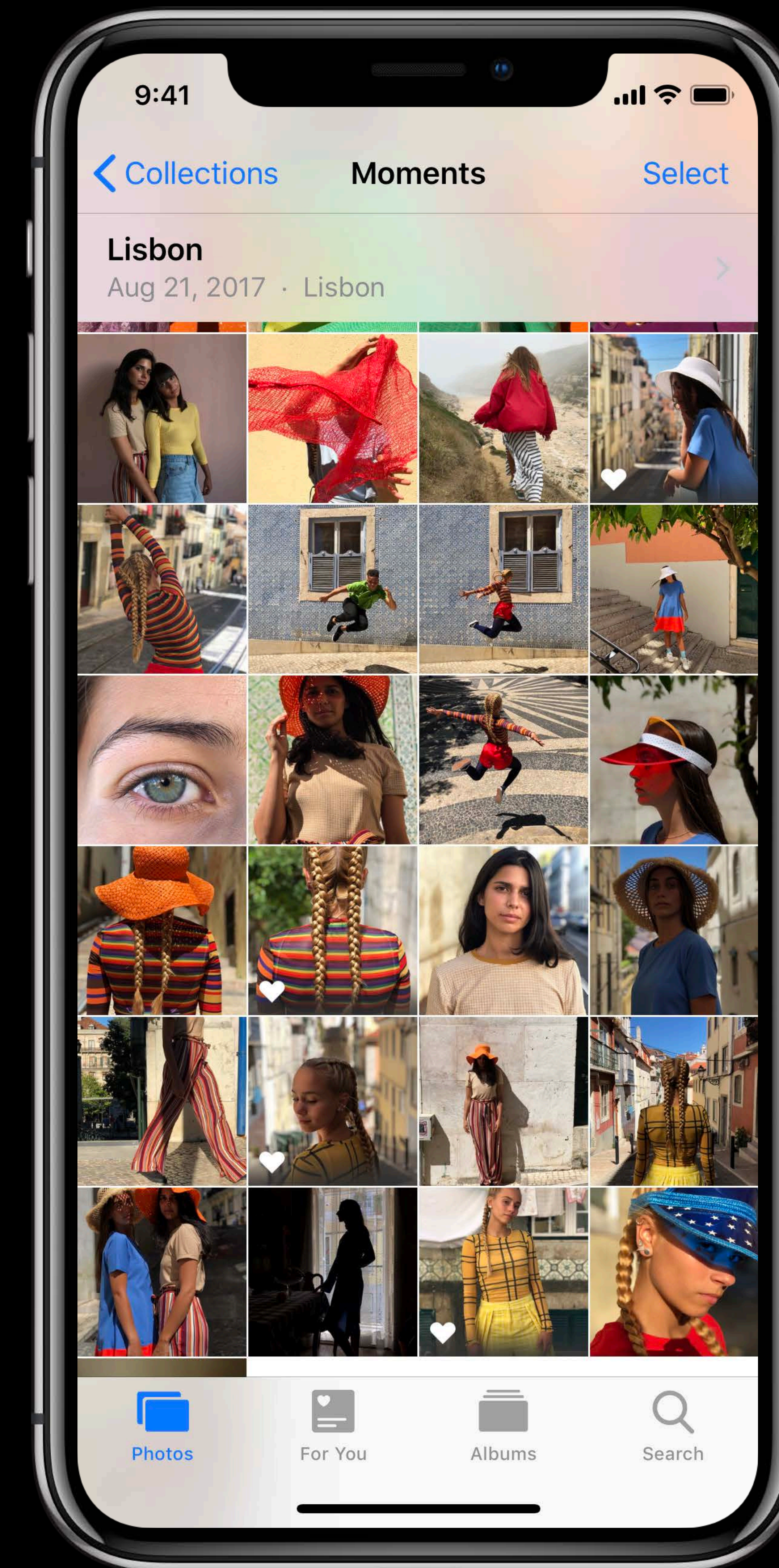
Launching to Moments

Breakdown



Launching to Moments

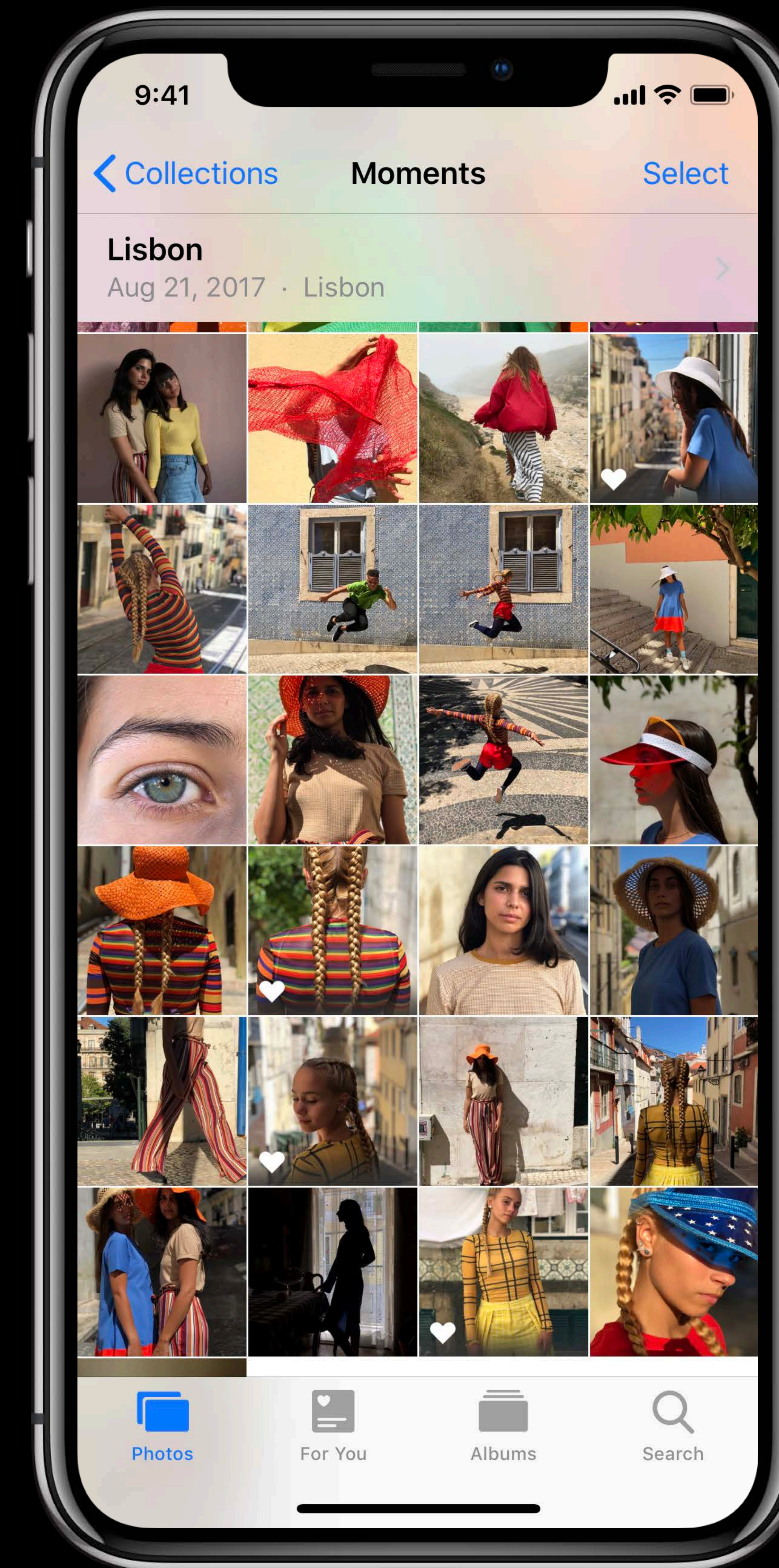
Breakdown—Initialize Database



Launching to Moments

Breakdown—Initialize Database

Load database early

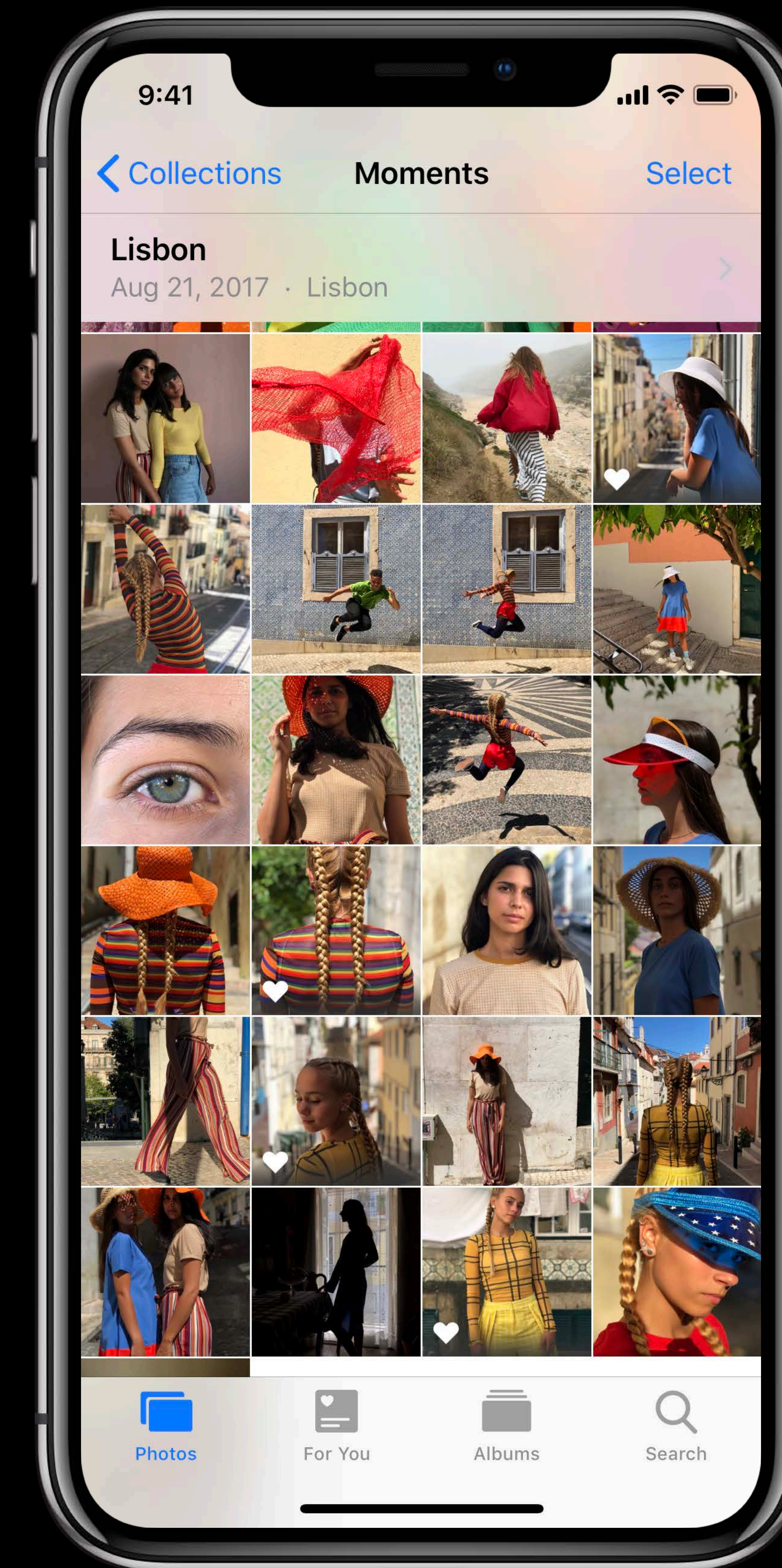


Launching to Moments

Breakdown—Initialize Database

Load database early

Review the queries done during launch



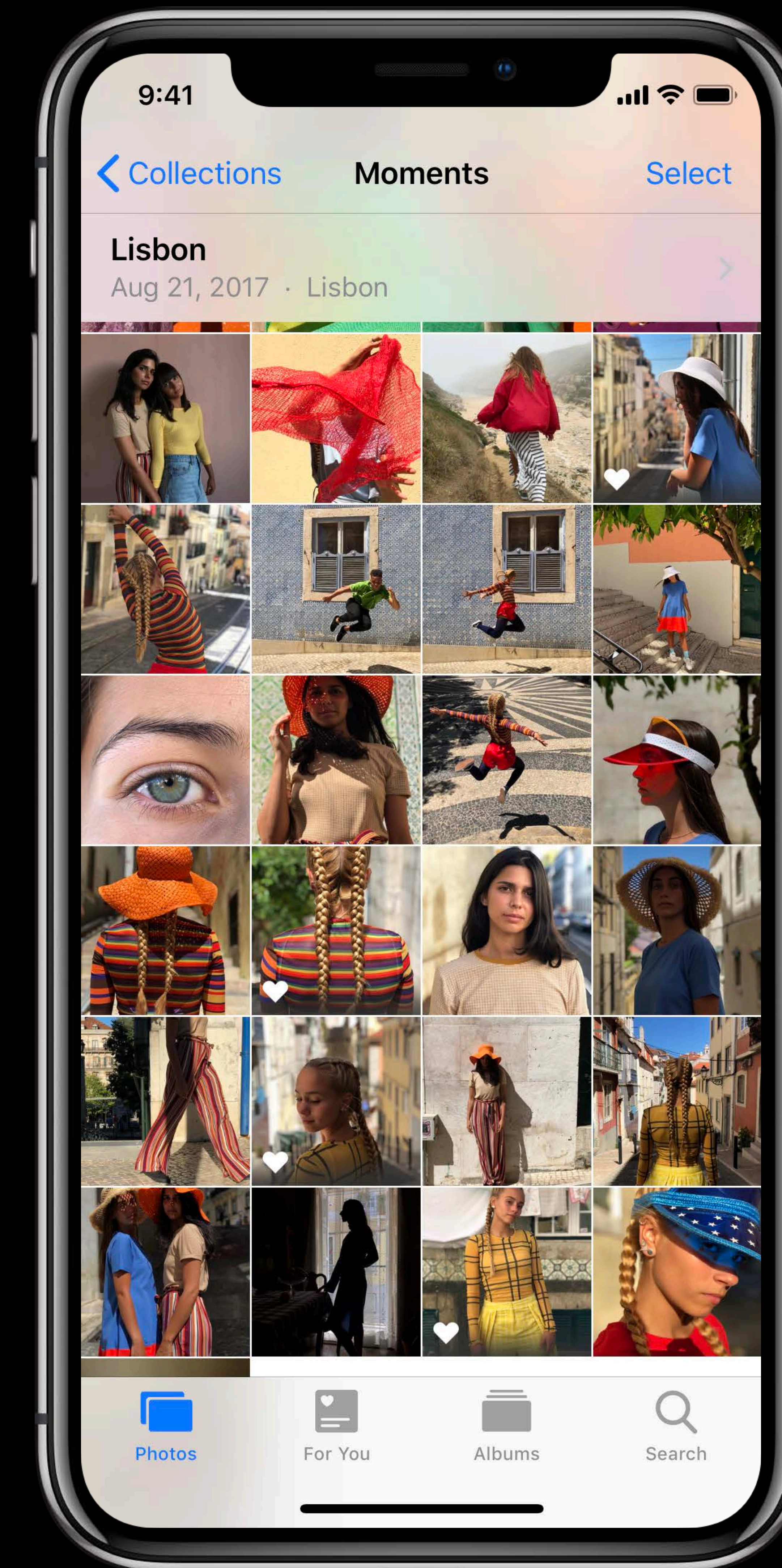
Launching to Moments

Breakdown—Initialize Database

Load database early

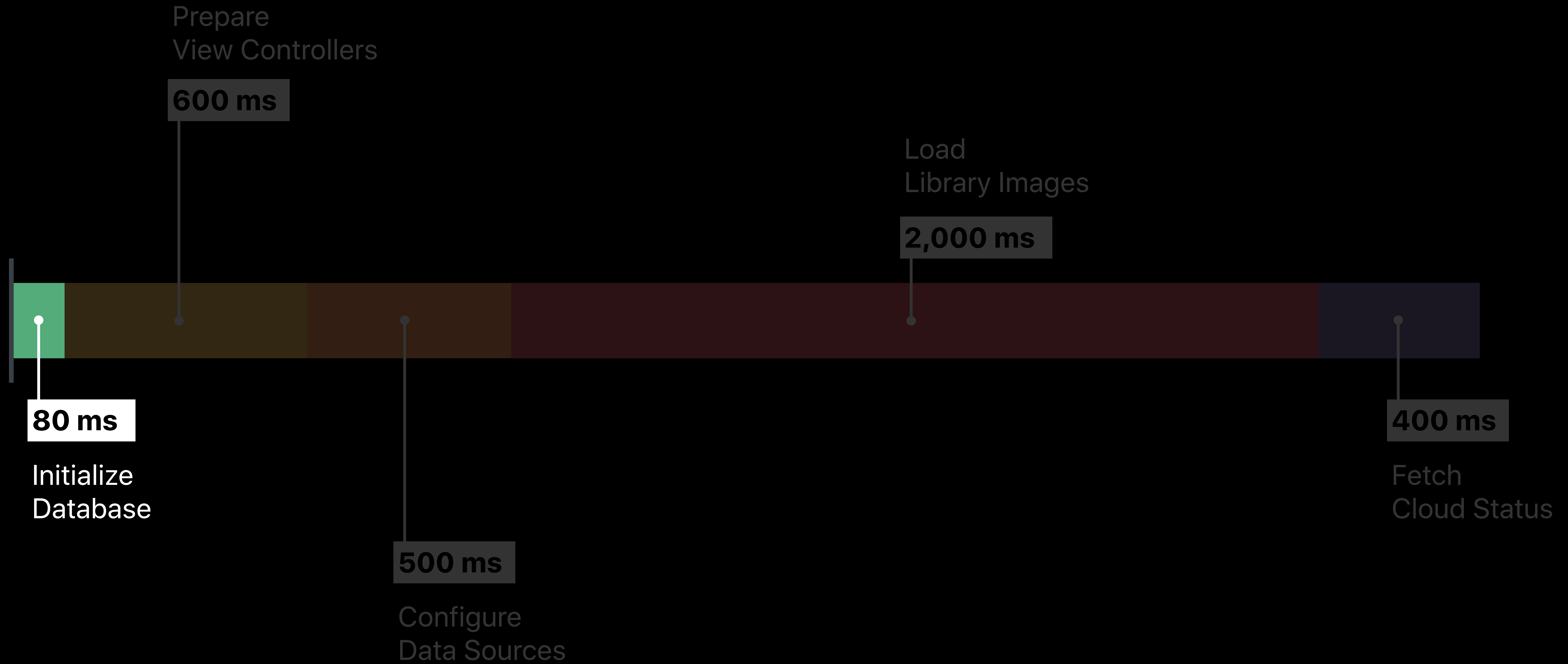
Review the queries done during launch

Ensure required queries are efficient as possible



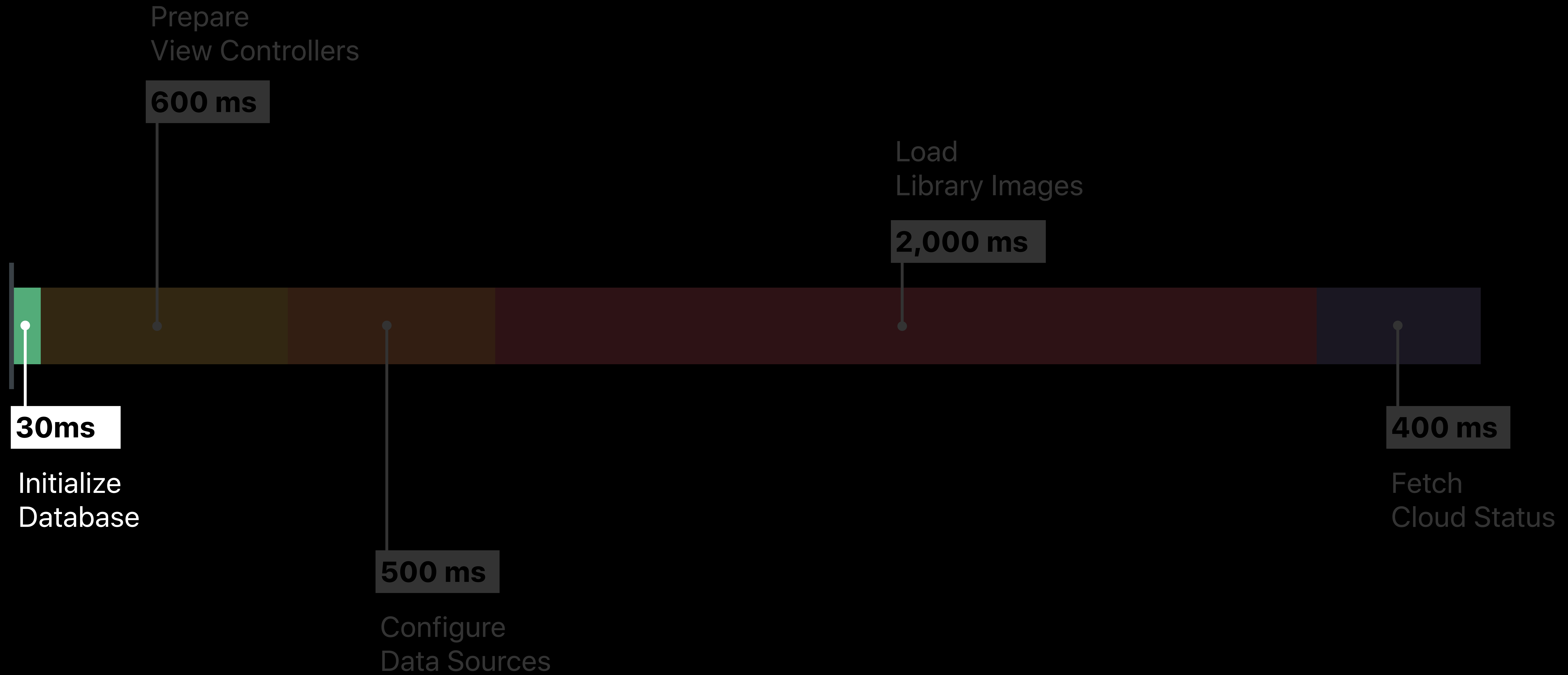
Launching to Moments

Breakdown



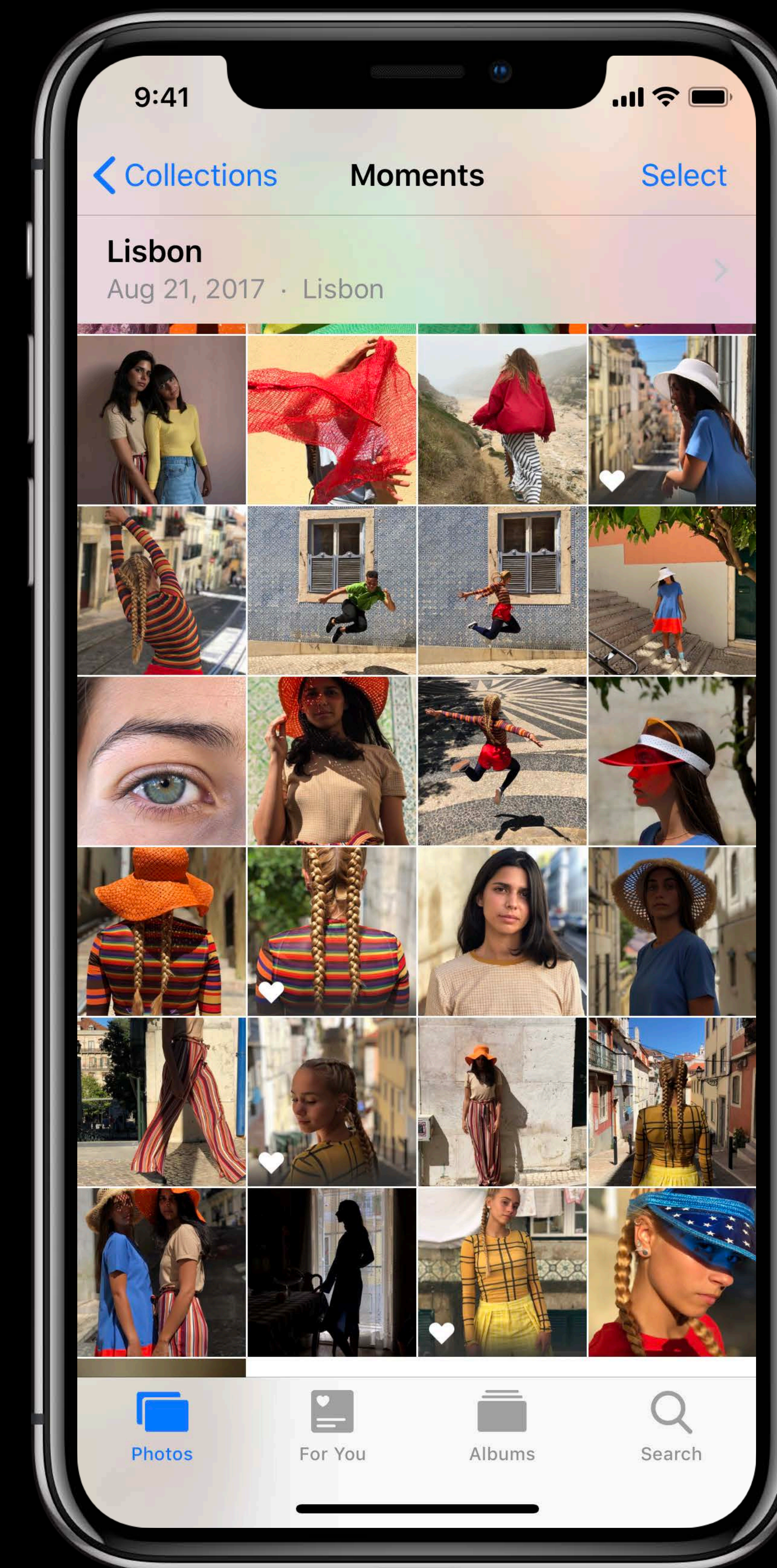
Launching to Moments

Breakdown



Launching to Moments

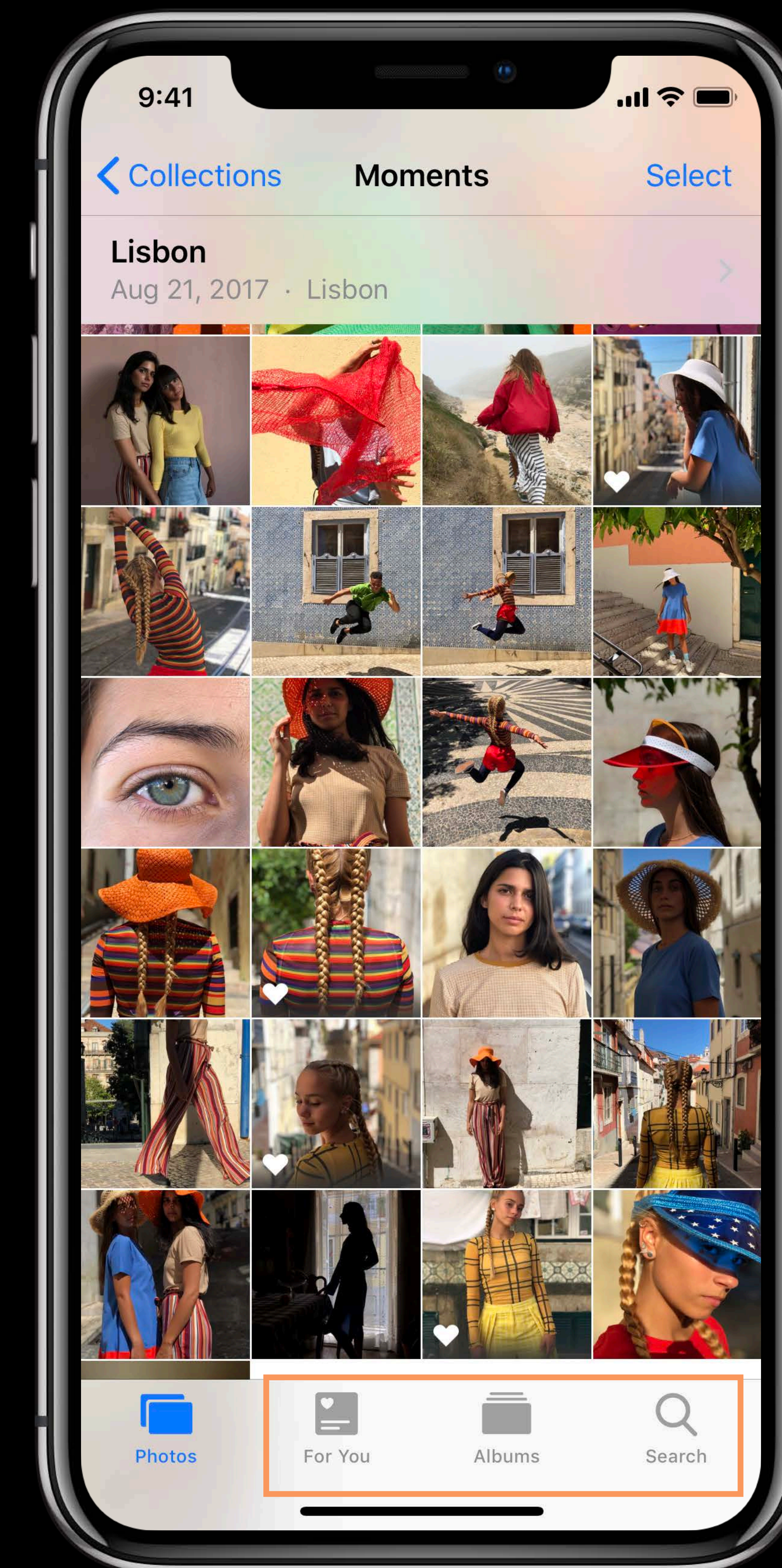
Breakdown—Prepare View Controllers



Launching to Moments

Breakdown—Prepare View Controllers

Minimize the preparation cost of non-visible view controllers

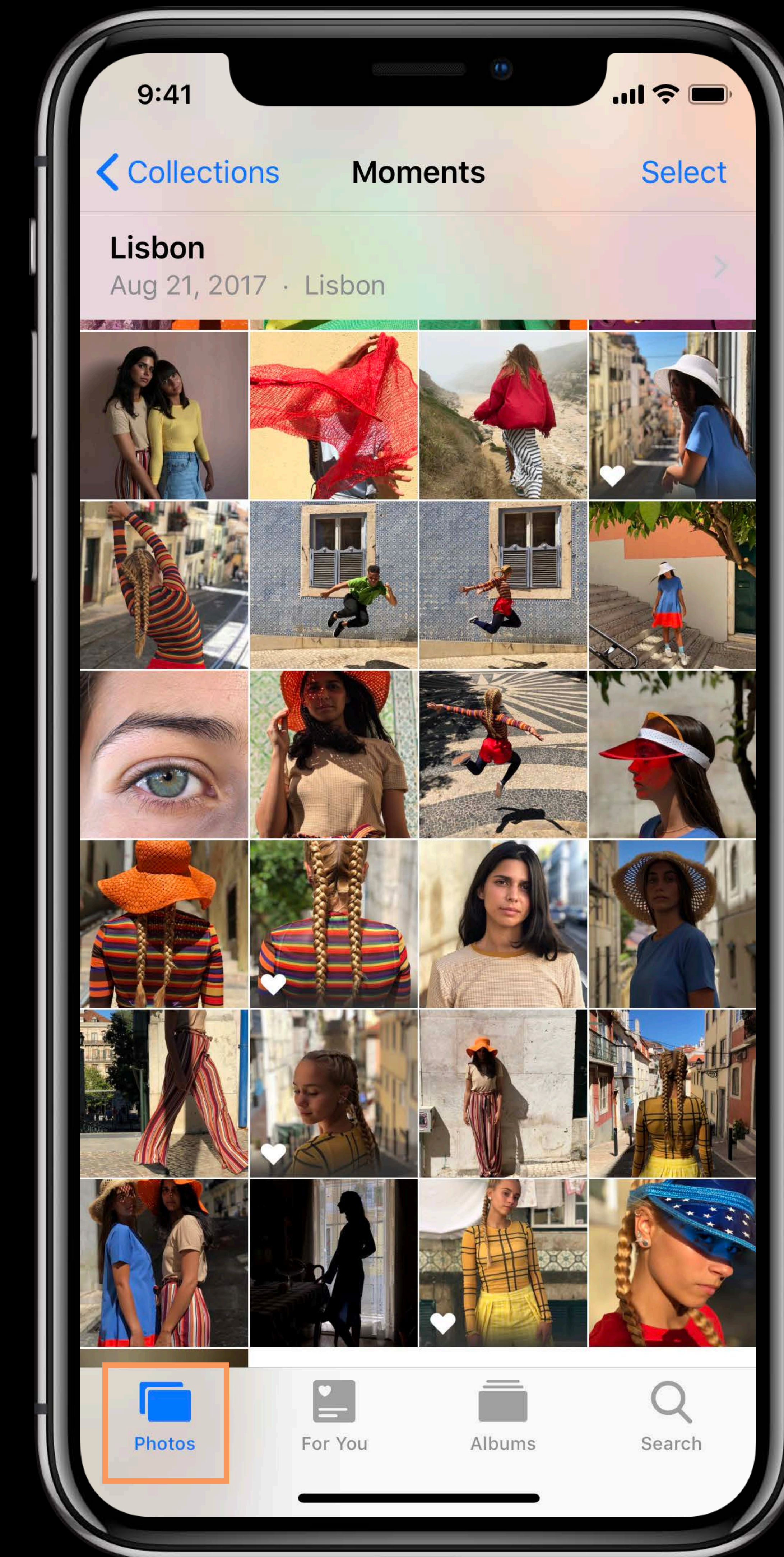


Launching to Moments

Breakdown—Prepare View Controllers

Minimize the preparation cost of non-visible view controllers

Do as little work as possible in the initializers



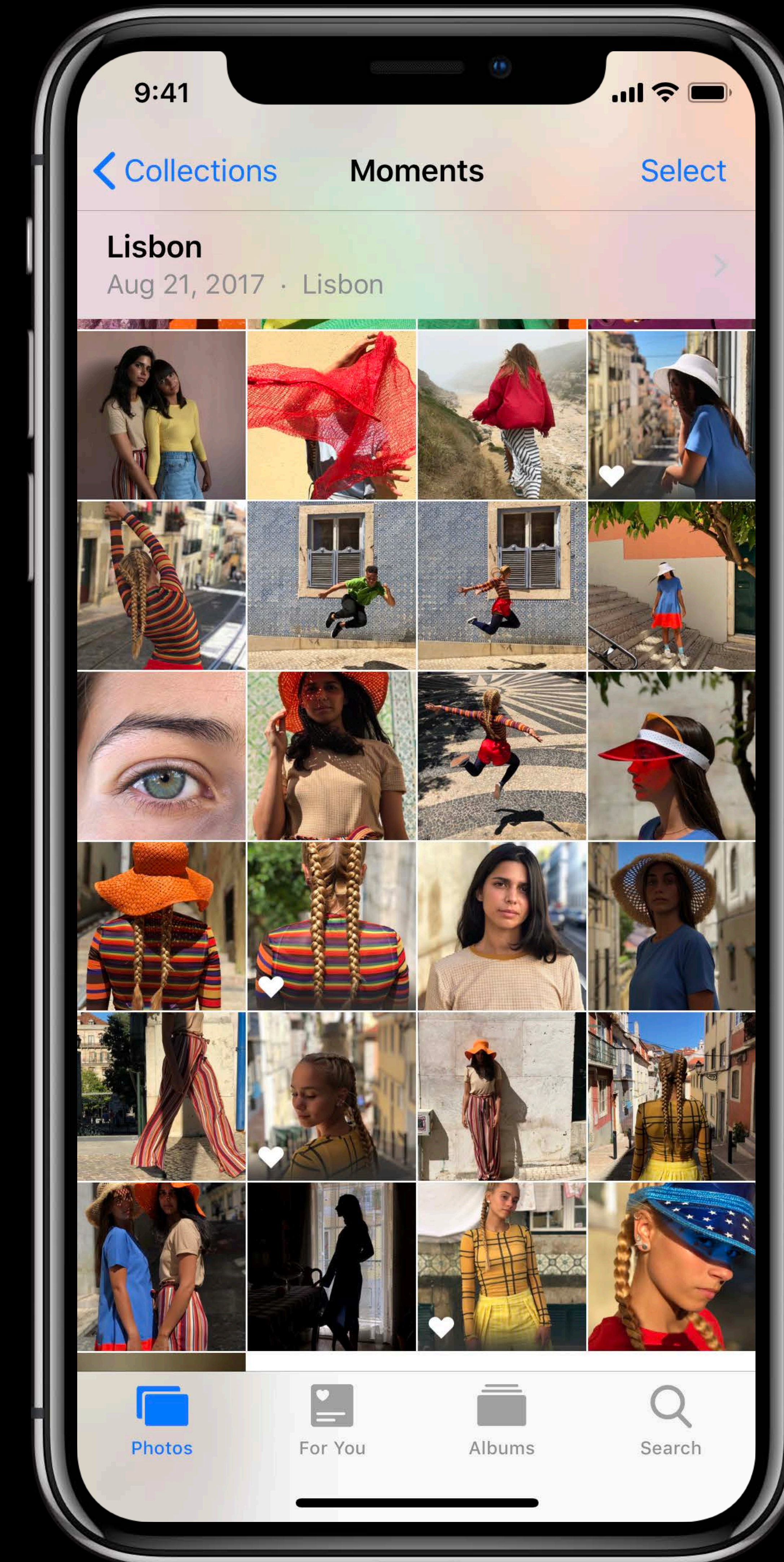
Launching to Moments

Breakdown—Prepare View Controllers

Minimize the preparation cost of non-visible view controllers

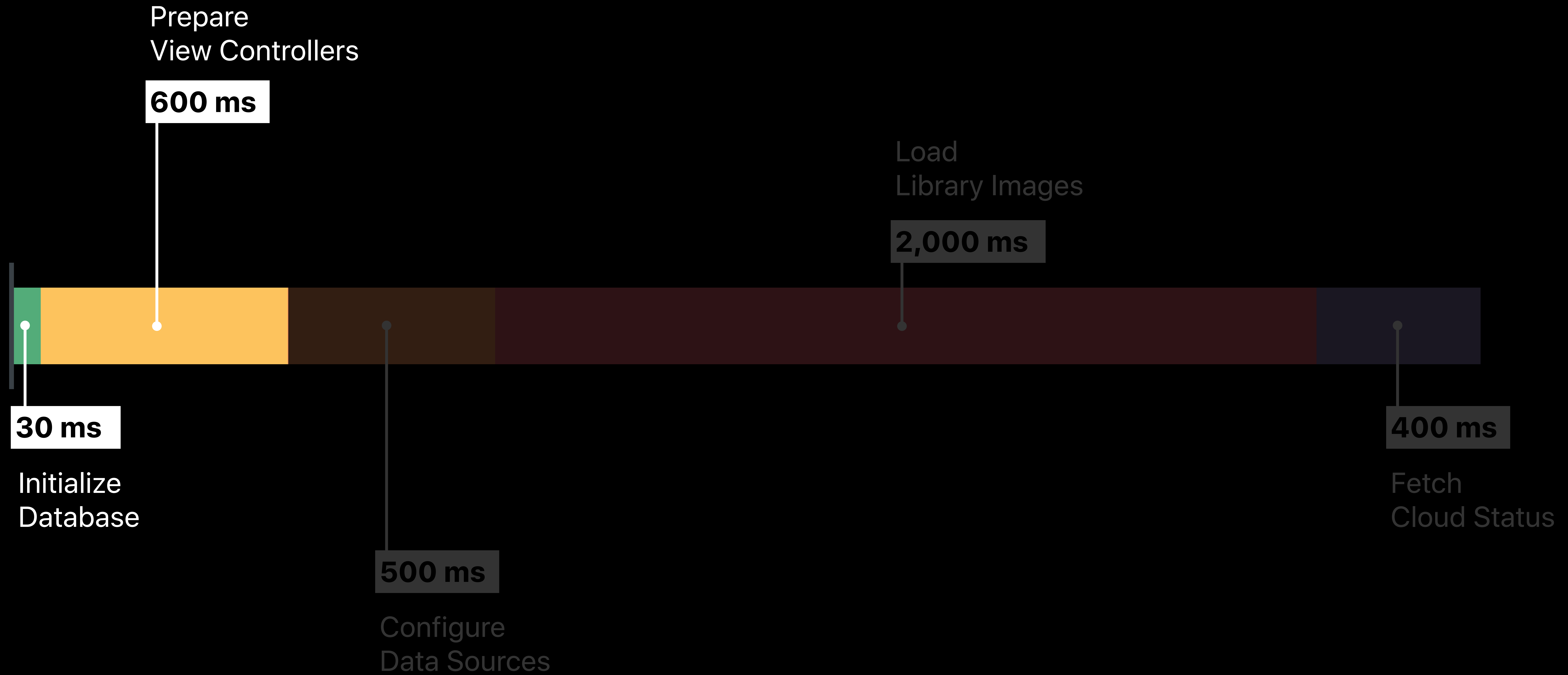
Do as little work as possible in the initializers

Ensure only visible views are loaded



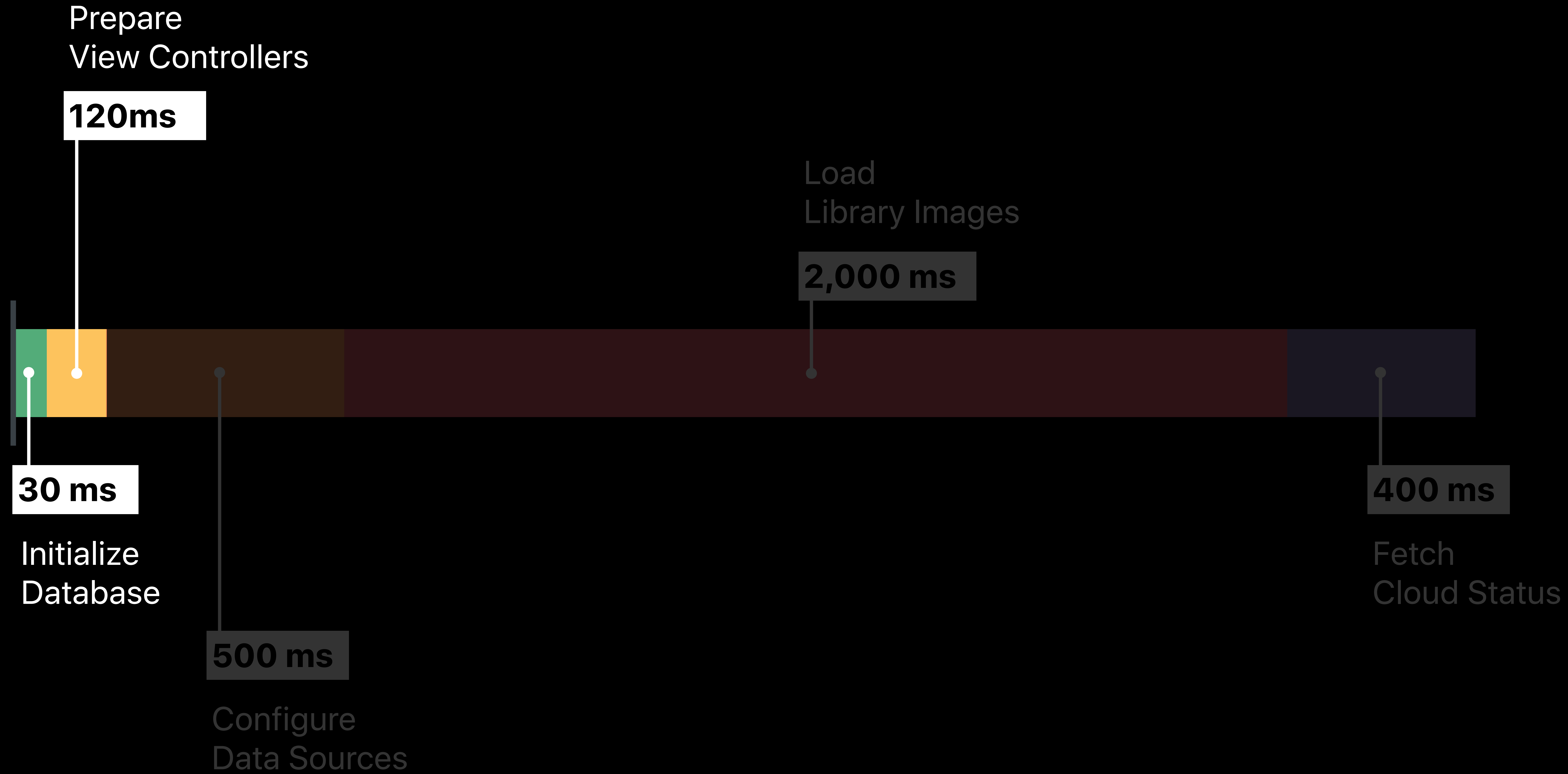
Launching to Moments

Breakdown



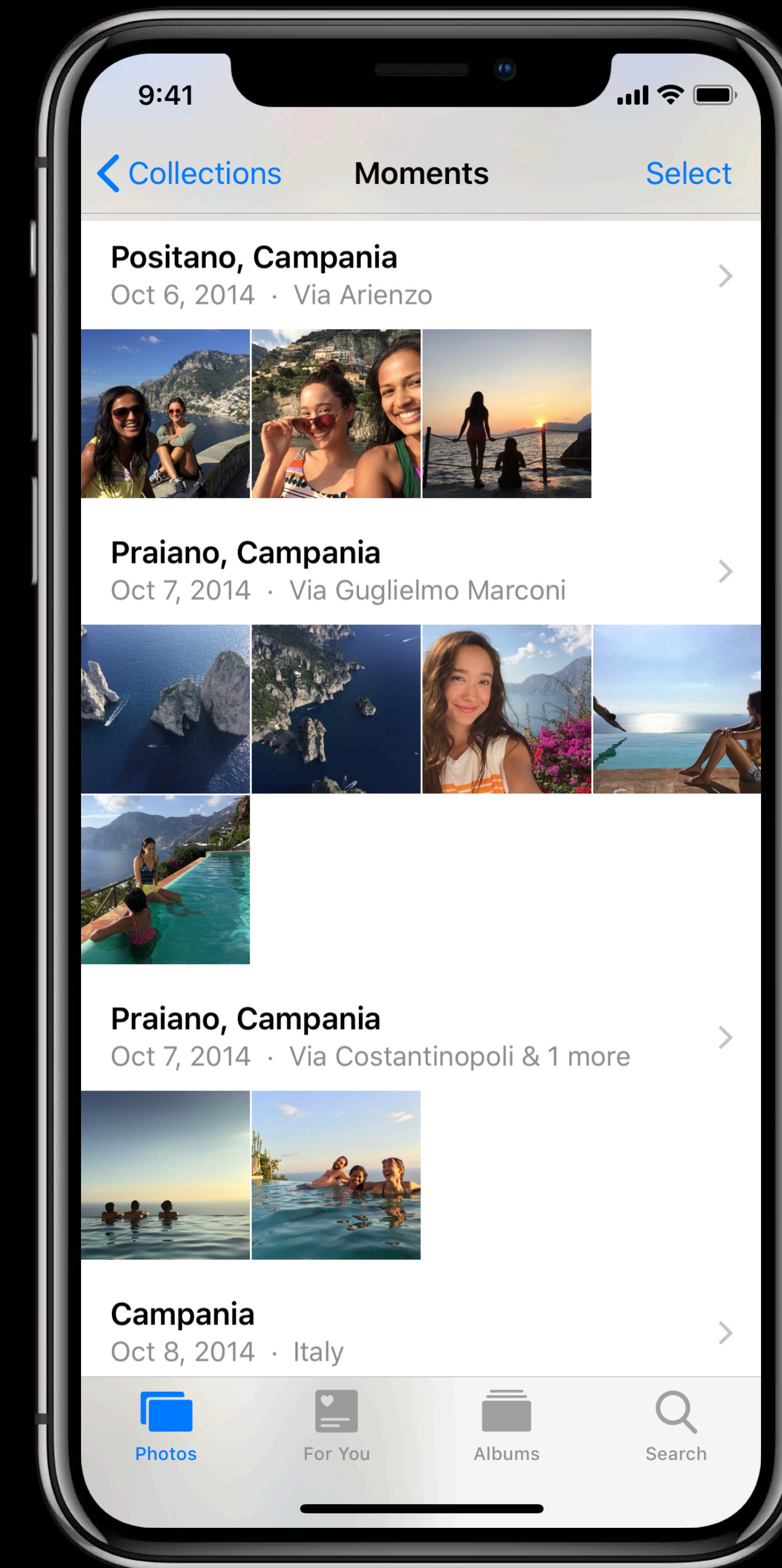
Launching to Moments

Breakdown



Launching to Moments

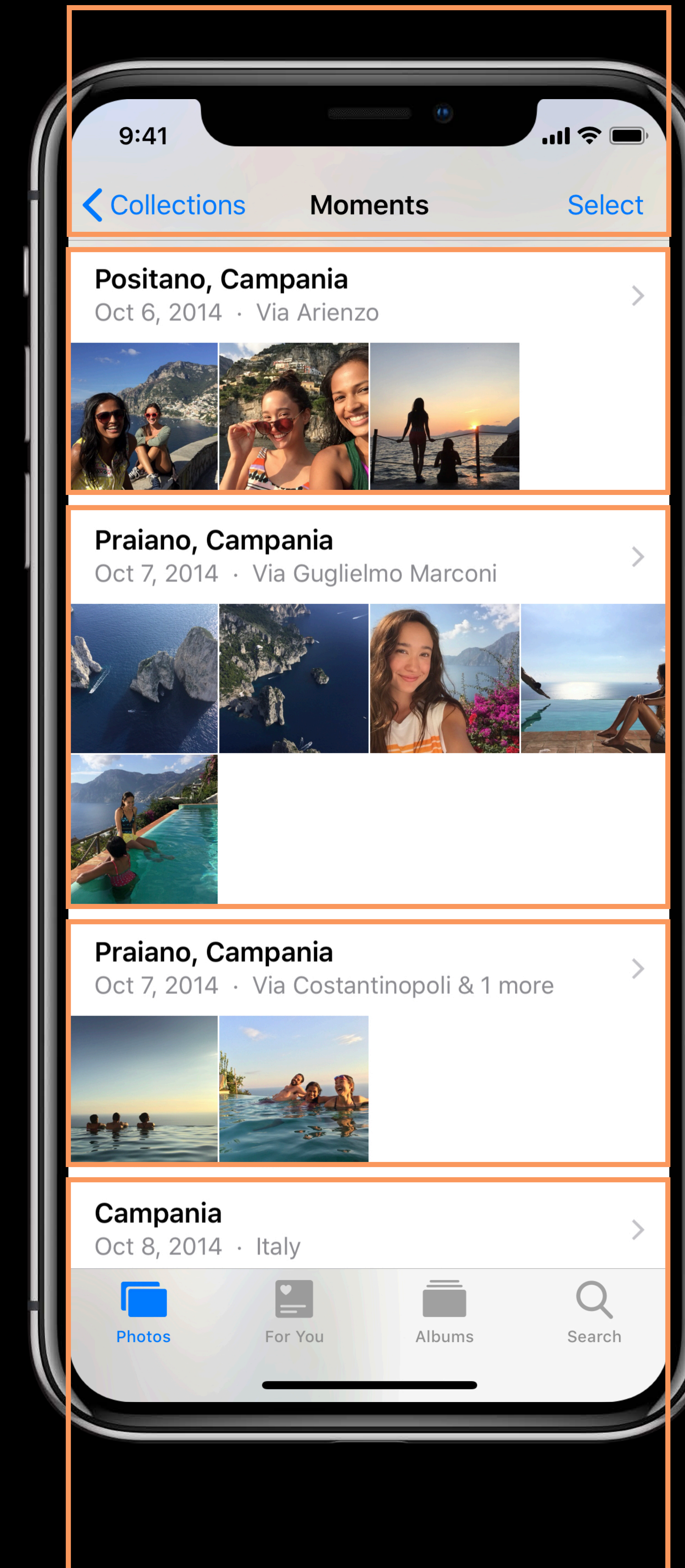
Breakdown—Configure Data Sources



Launching to Moments

Breakdown—Configure Data Sources

Load only the needed data synchronously

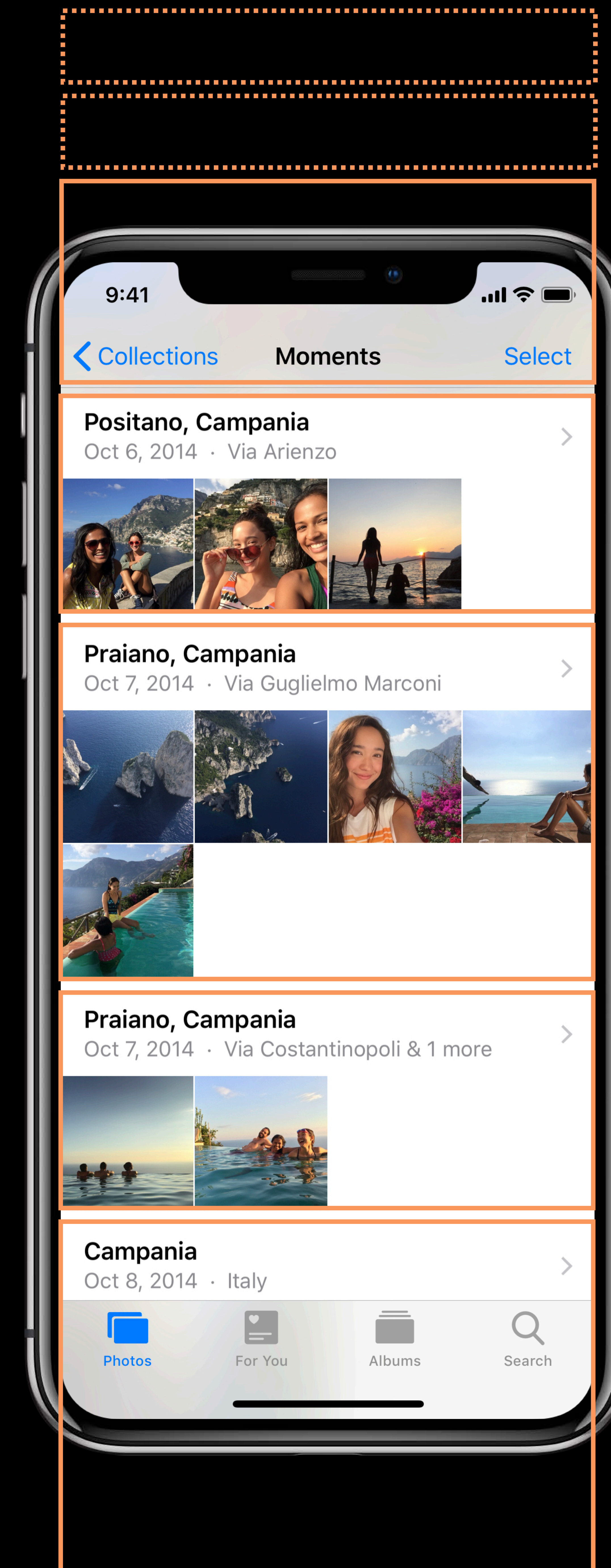


Launching to Moments

Breakdown—Configure Data Sources

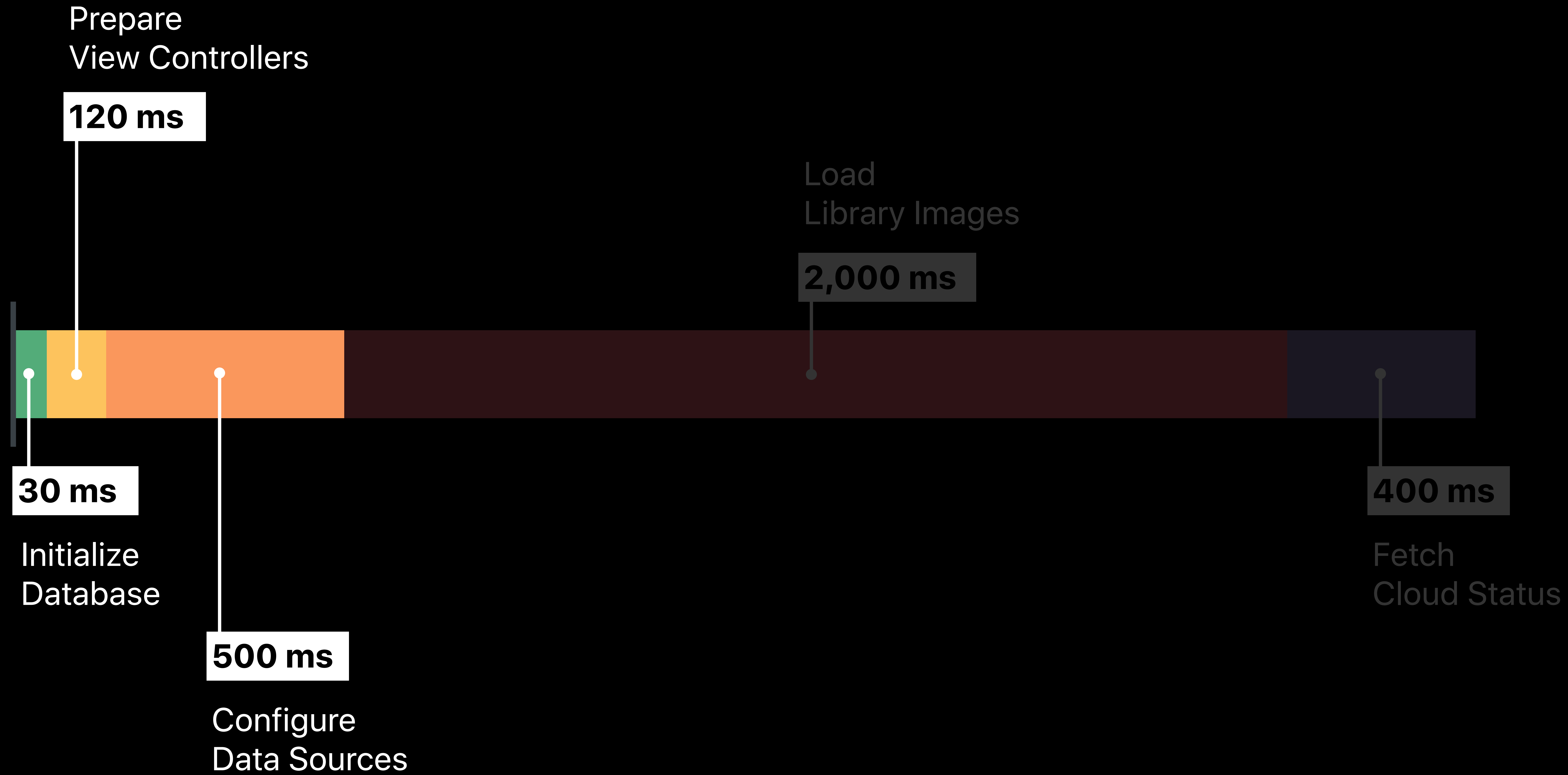
Load only the needed data synchronously

Schedule preheating of the remaining data
asynchronously



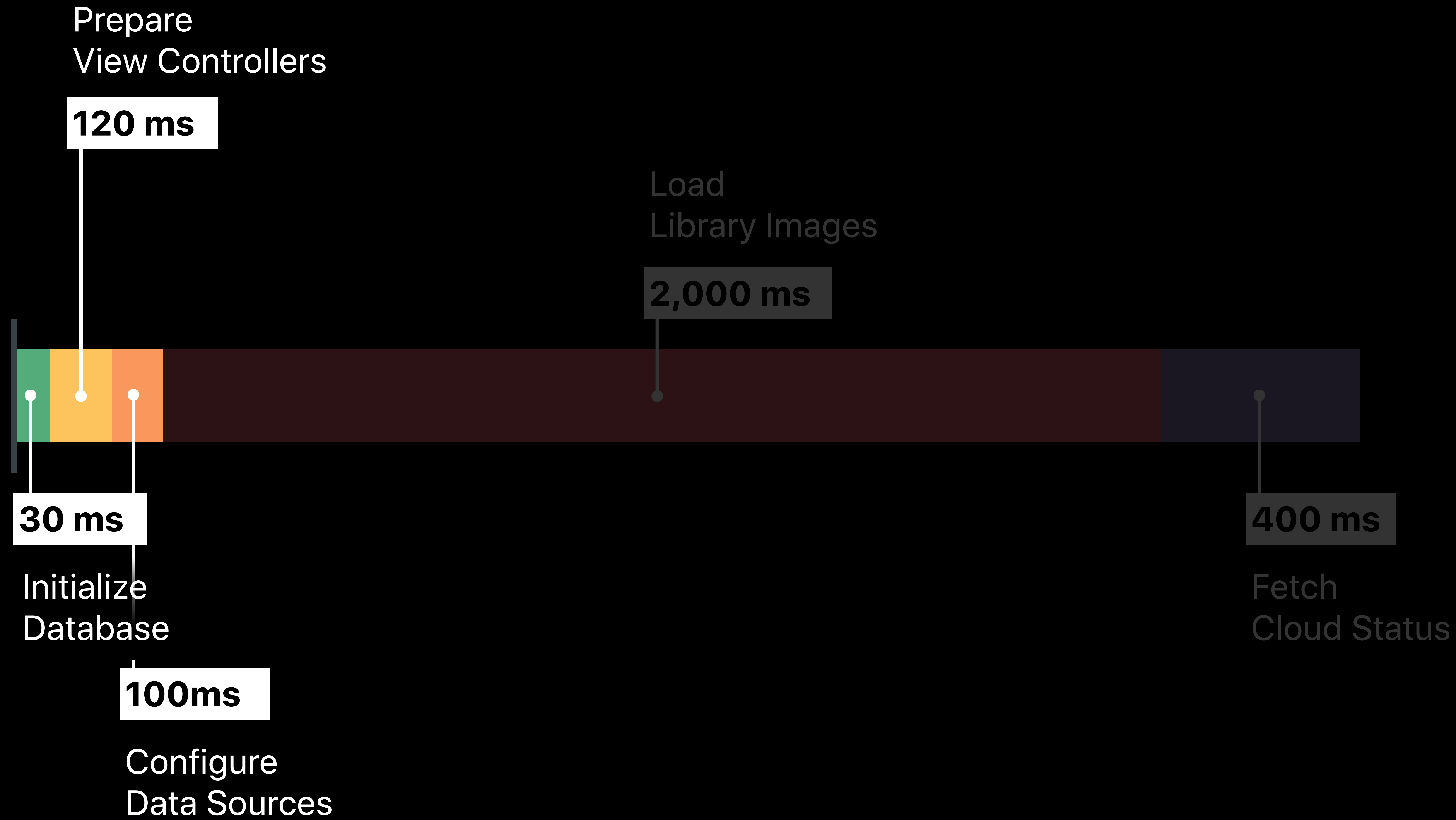
Launching to Moments

Breakdown



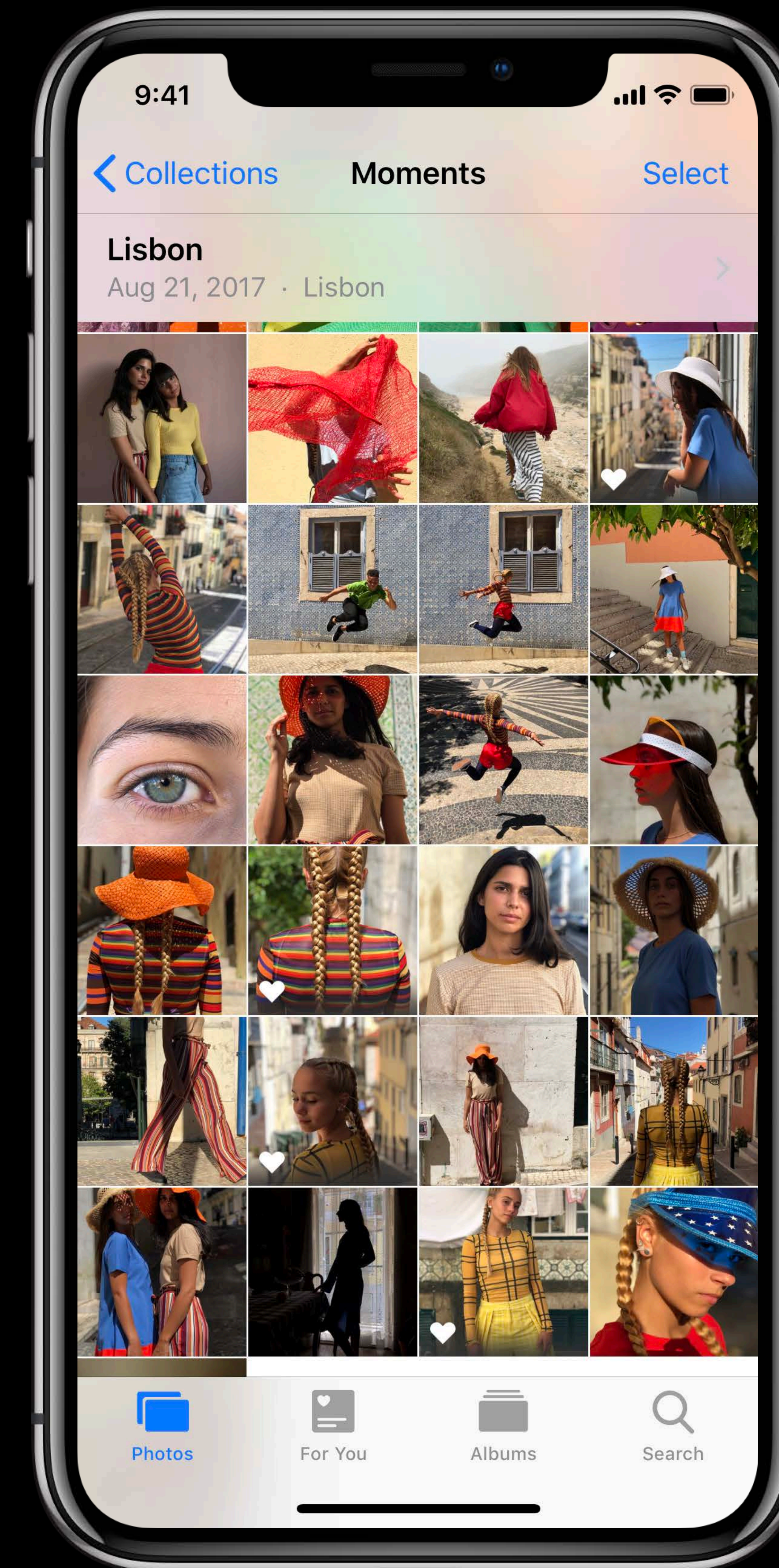
Launching to Moments

Breakdown



Launching to Moments

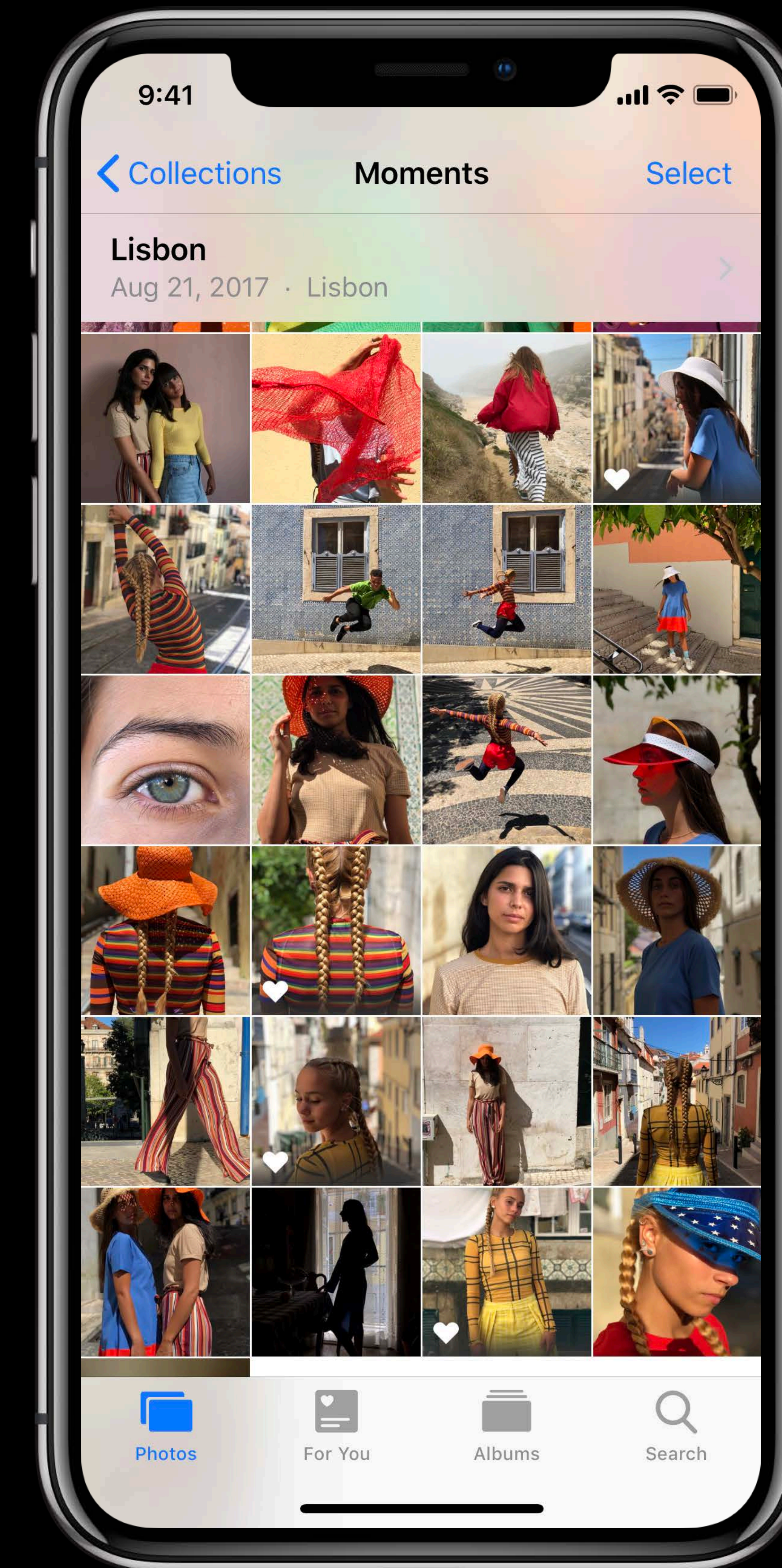
Breakdown—Load Library Images



Launching to Moments

Breakdown—Load Library Images

Evaluate number of images needed

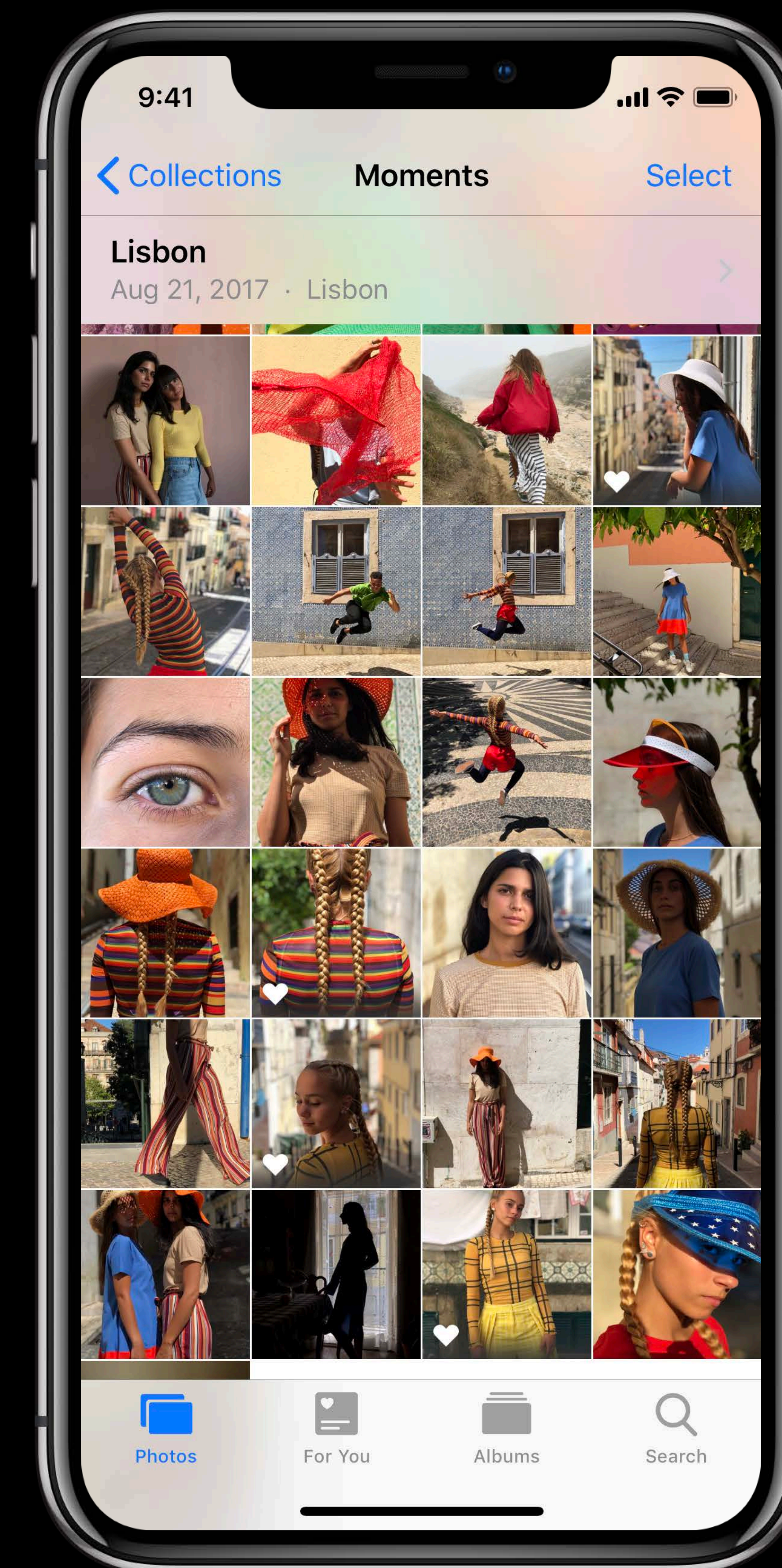


Launching to Moments

Breakdown—Load Library Images

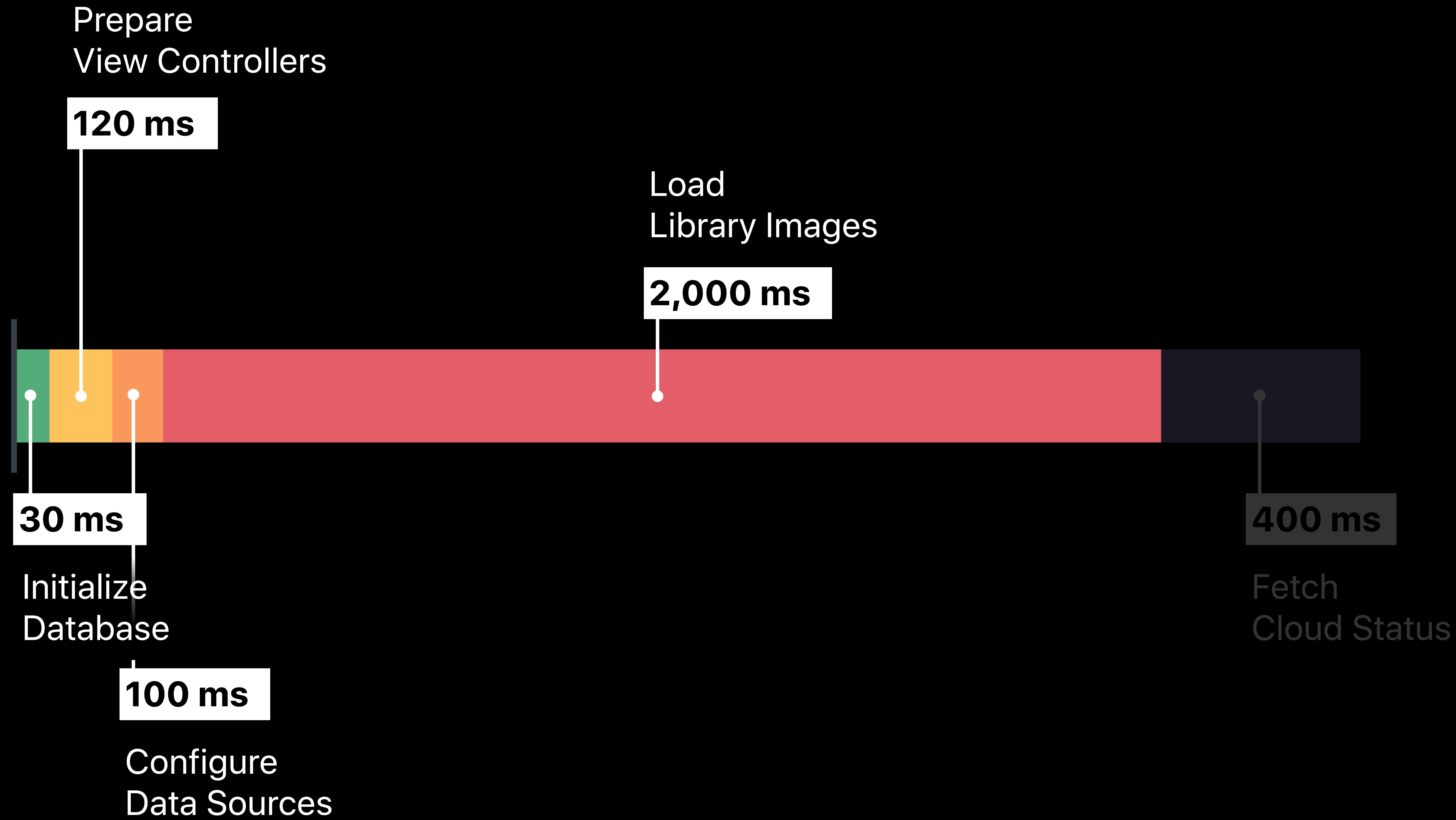
Evaluate number of images needed

Load low resolution thumbnails



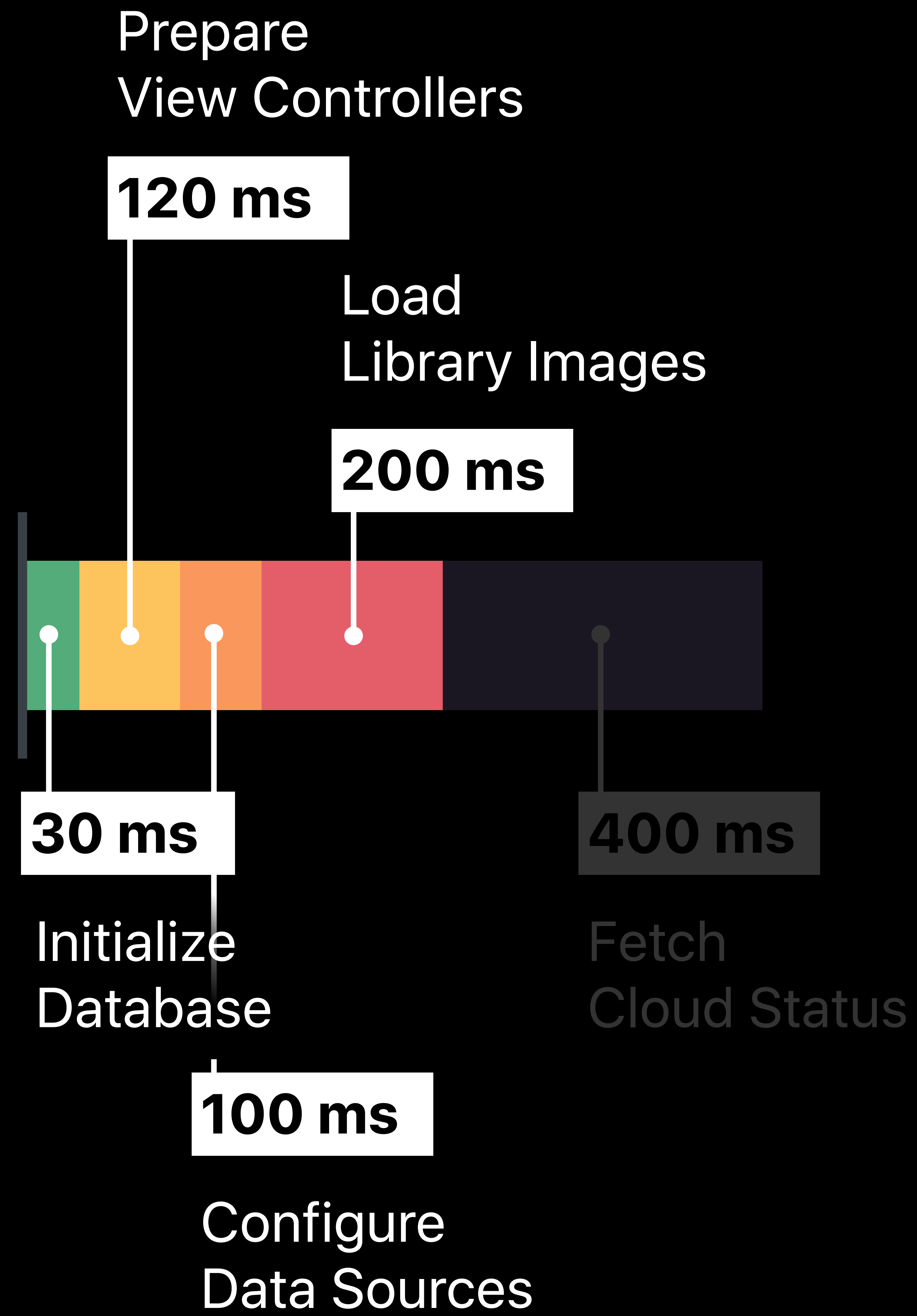
Launching to Moments

Breakdown



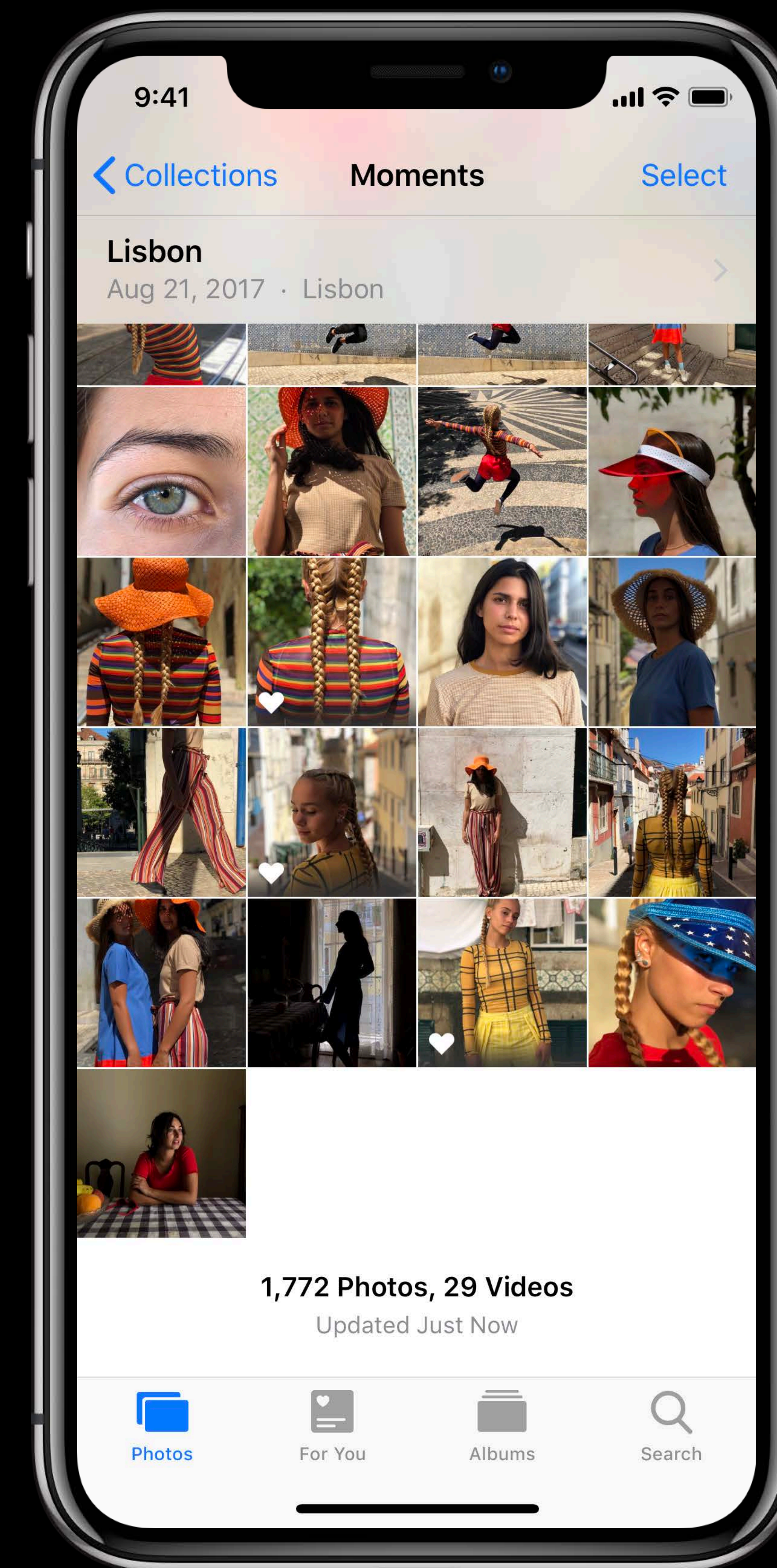
Launching to Moments

Breakdown



Launching to Moments

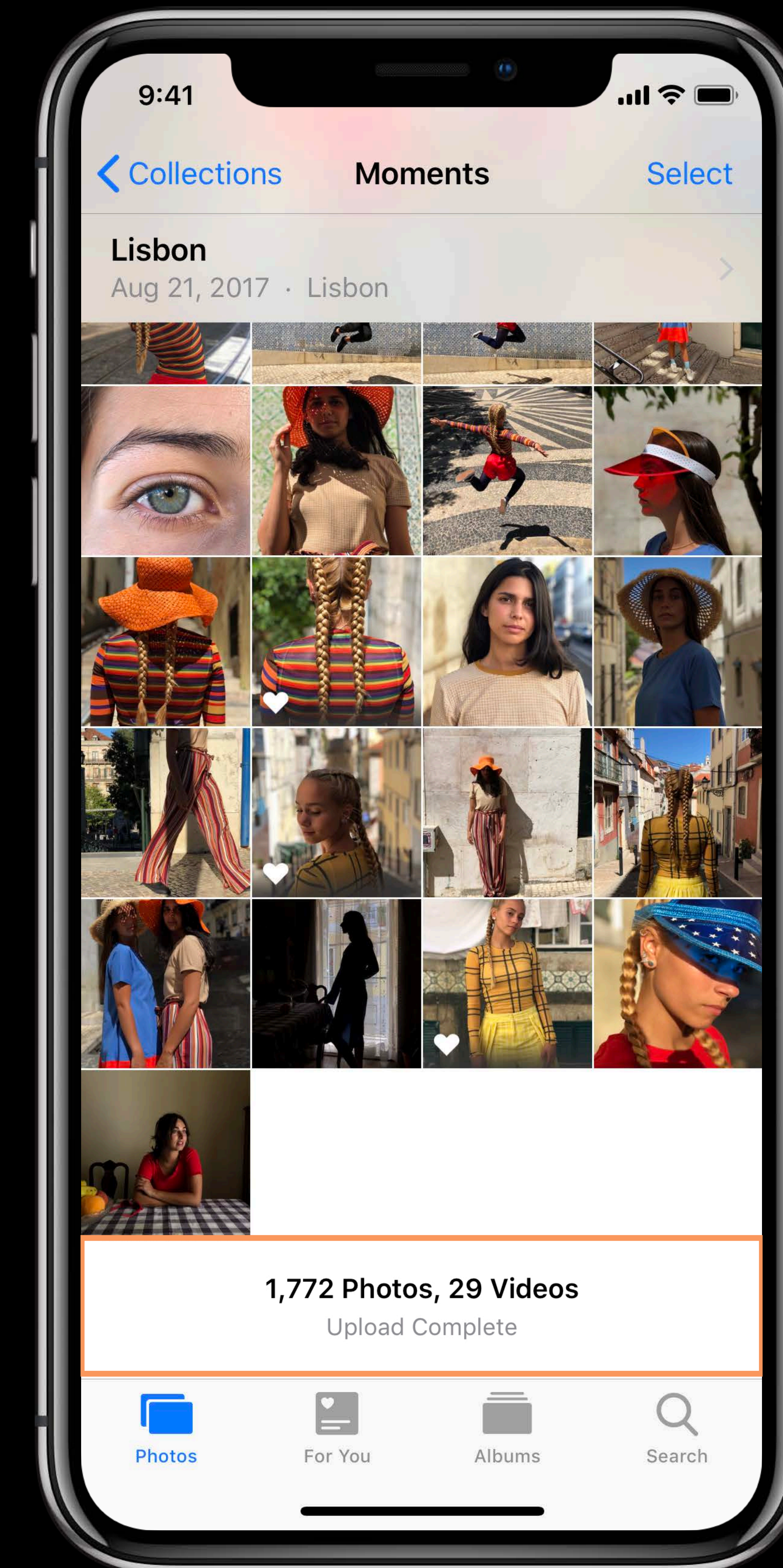
Breakdown—Fetch Cloud Status



Launching to Moments

Breakdown—Fetch Cloud Status

Evaluate if information is needed during launch

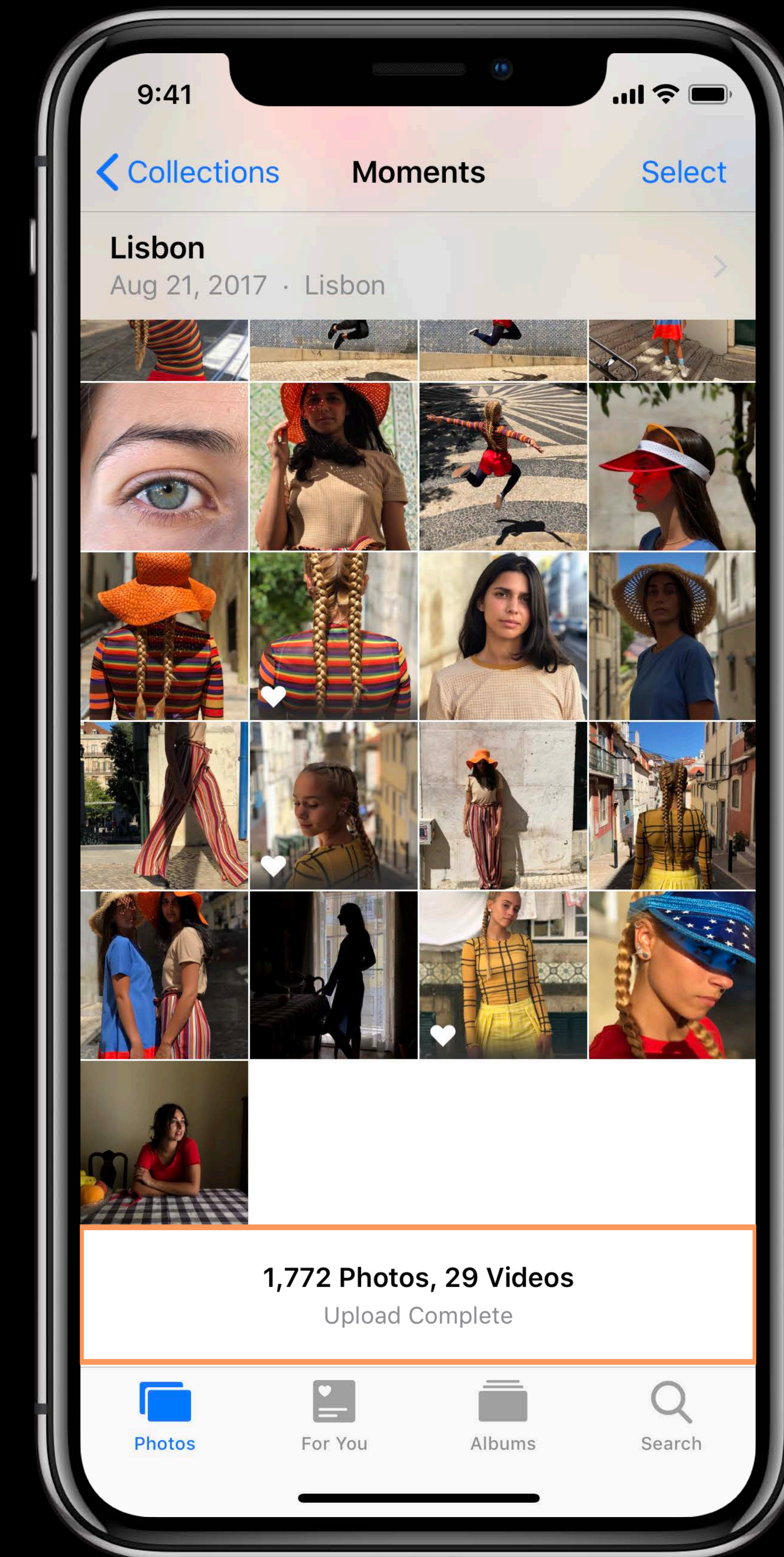


Launching to Moments

Breakdown—Fetch Cloud Status

Evaluate if information is needed during launch

Cache information



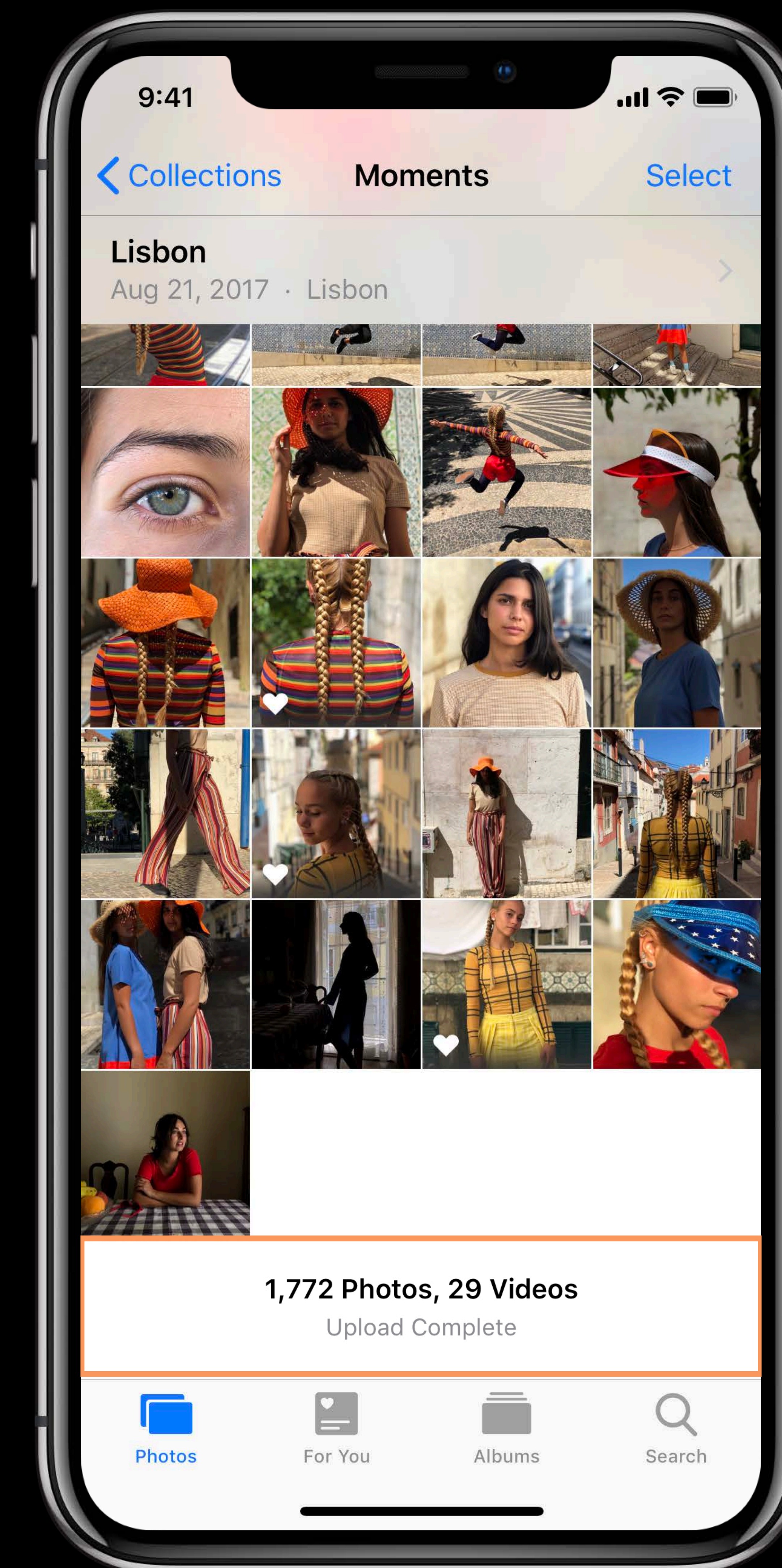
Launching to Moments

Breakdown—Fetch Cloud Status

Evaluate if information is needed during launch

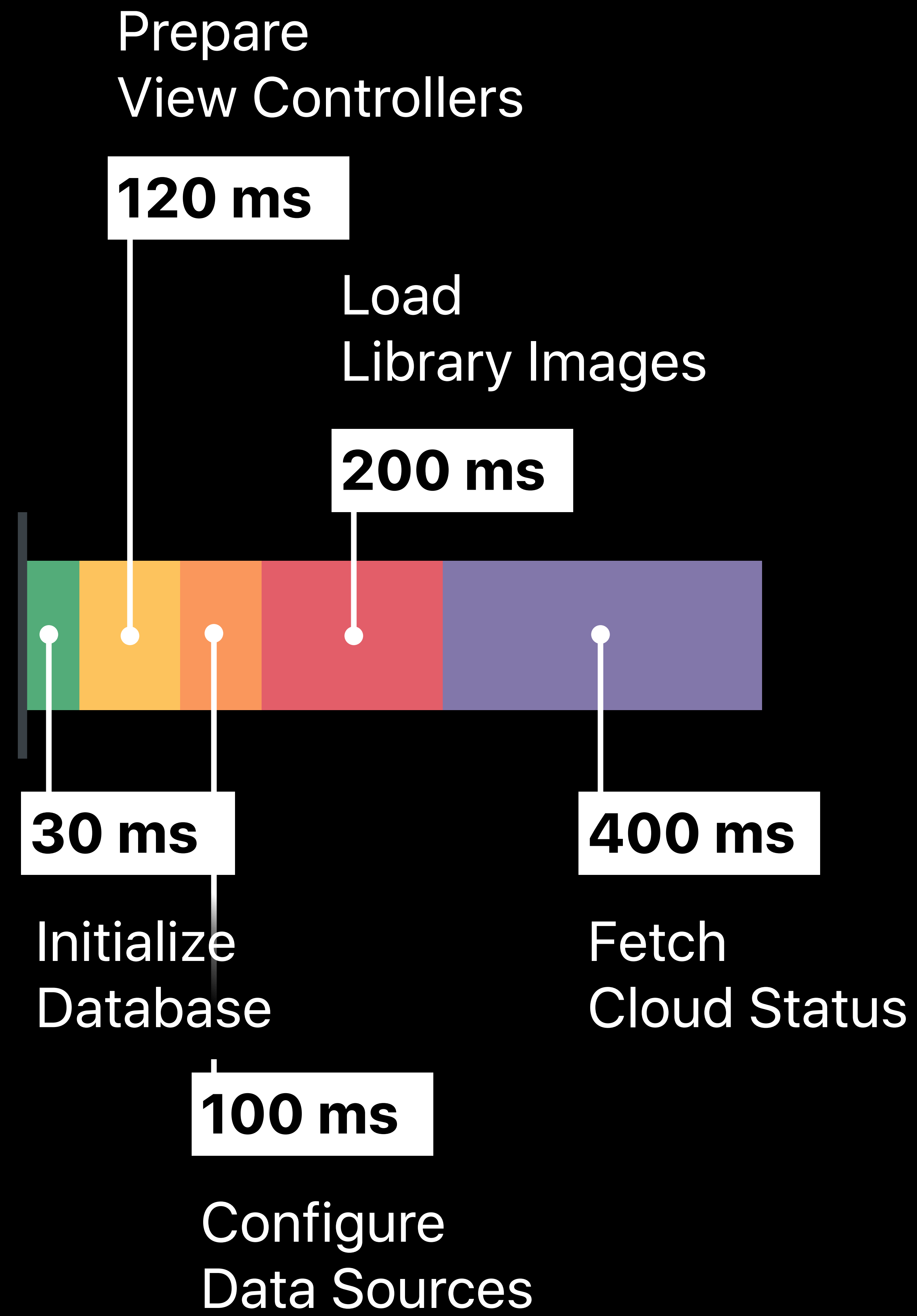
Cache information

Leverage Background App Refresh



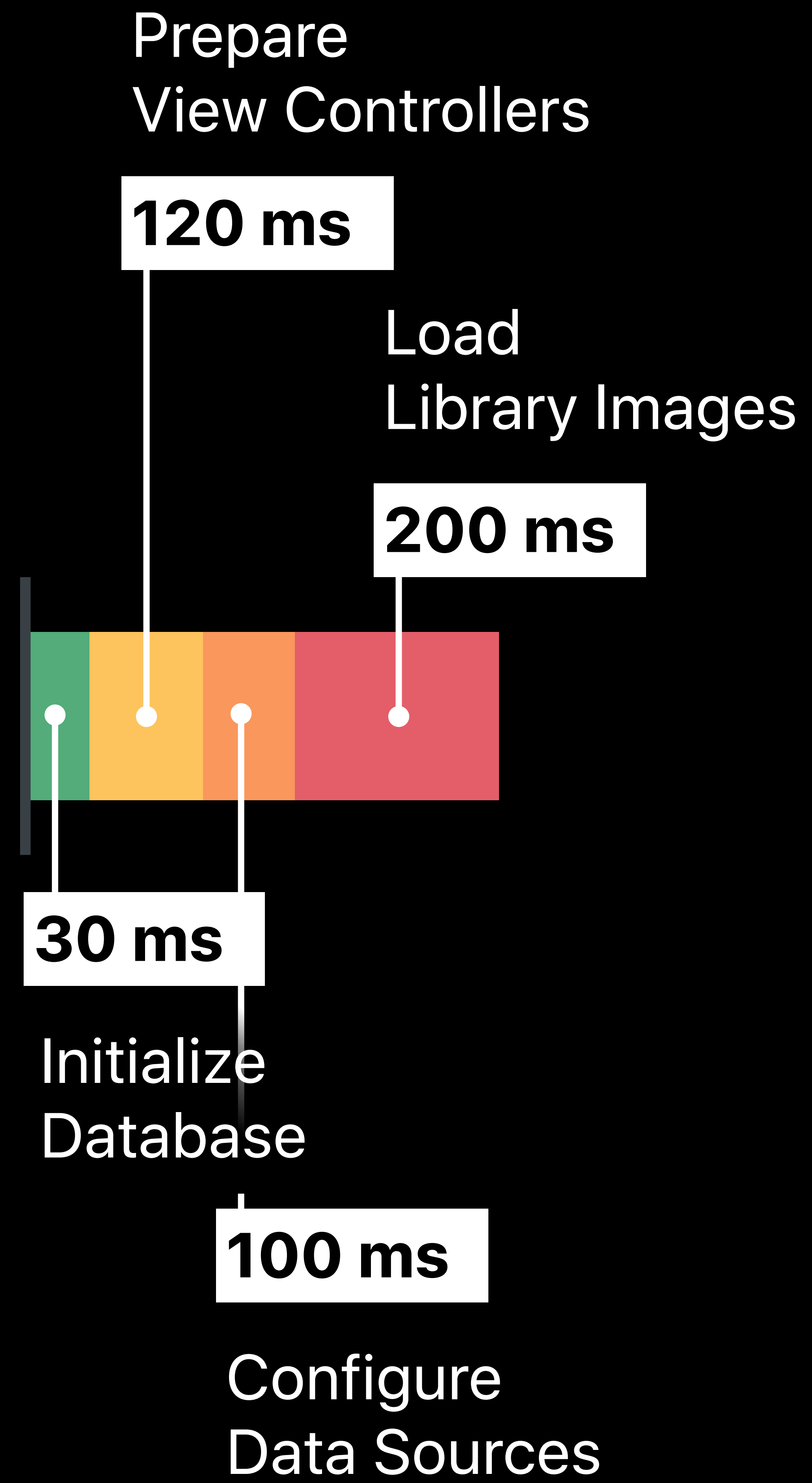
Launching to Moments

Breakdown



Launching to Moments

Breakdown



Launching to Moments

Breakdown



Think about the cost
of preparing content

Measure the cost
of preparing content

Strive for constant time

Launching to Moments

Building Collections/Years

9:41



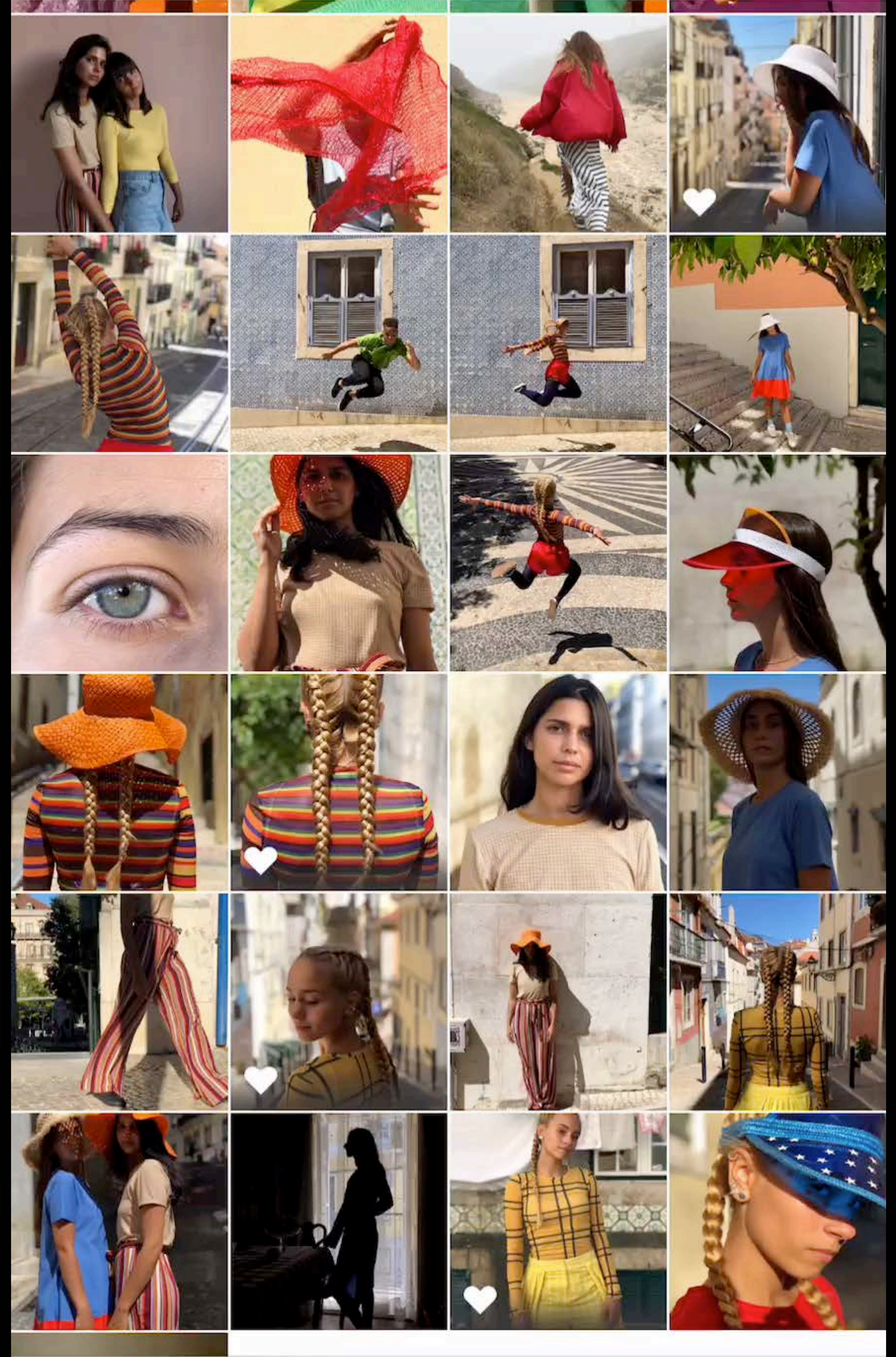
< Collections

Moments

Select

Lisbon

Aug 21, 2017 · Lisbon



Photos



For You



Albums



Search

9:41



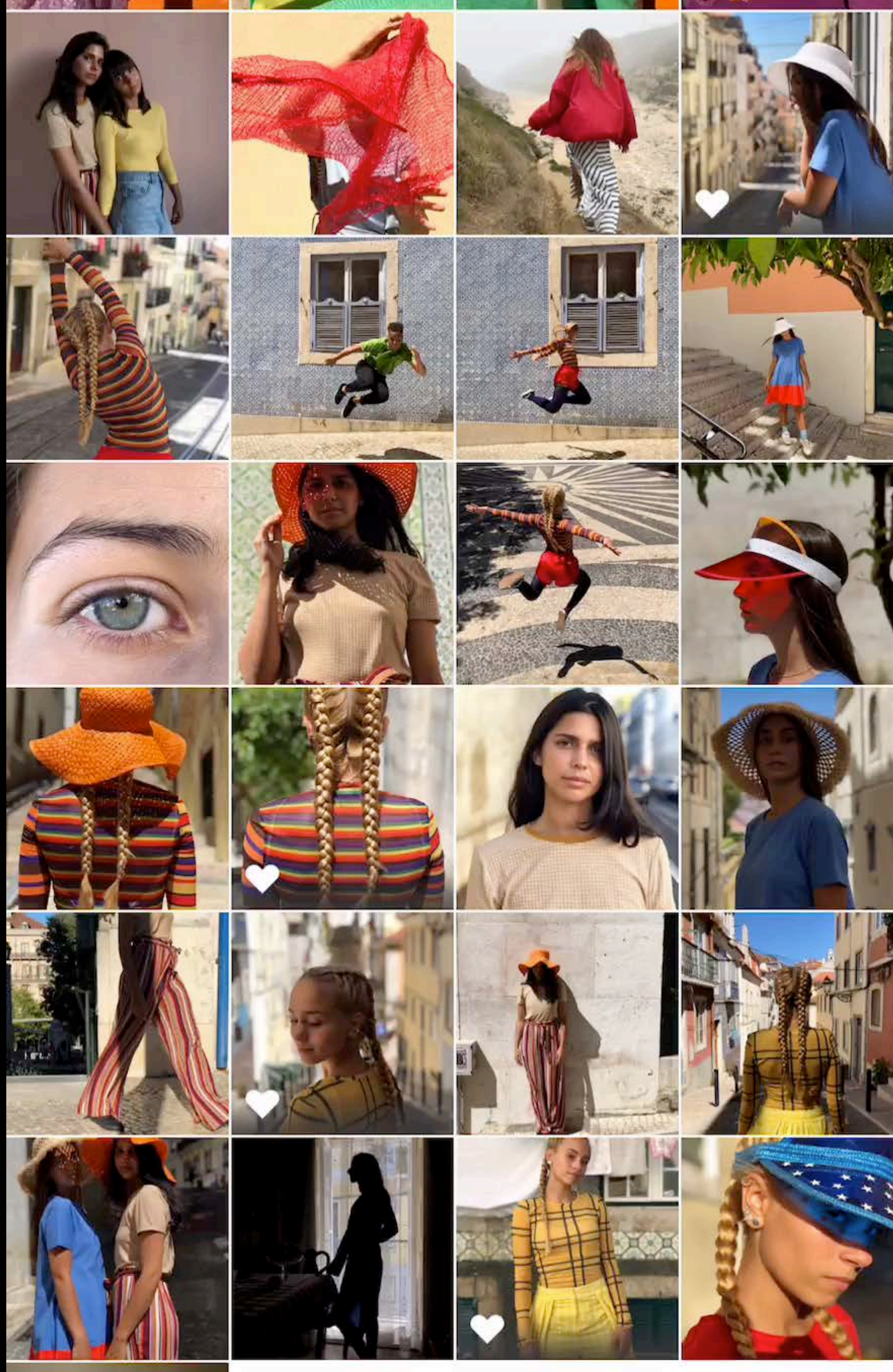
< Collections

Moments

Select

Lisbon

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Photos



For You



Albums



Search

9:41



< Years

Collections

Nashville

May 6–11, 2017 · Tennessee



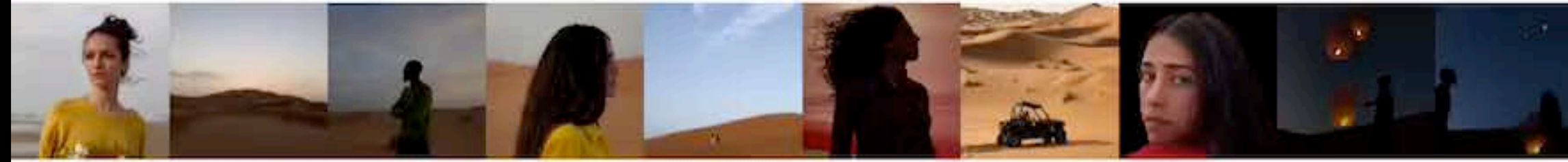
Marrakech Médina

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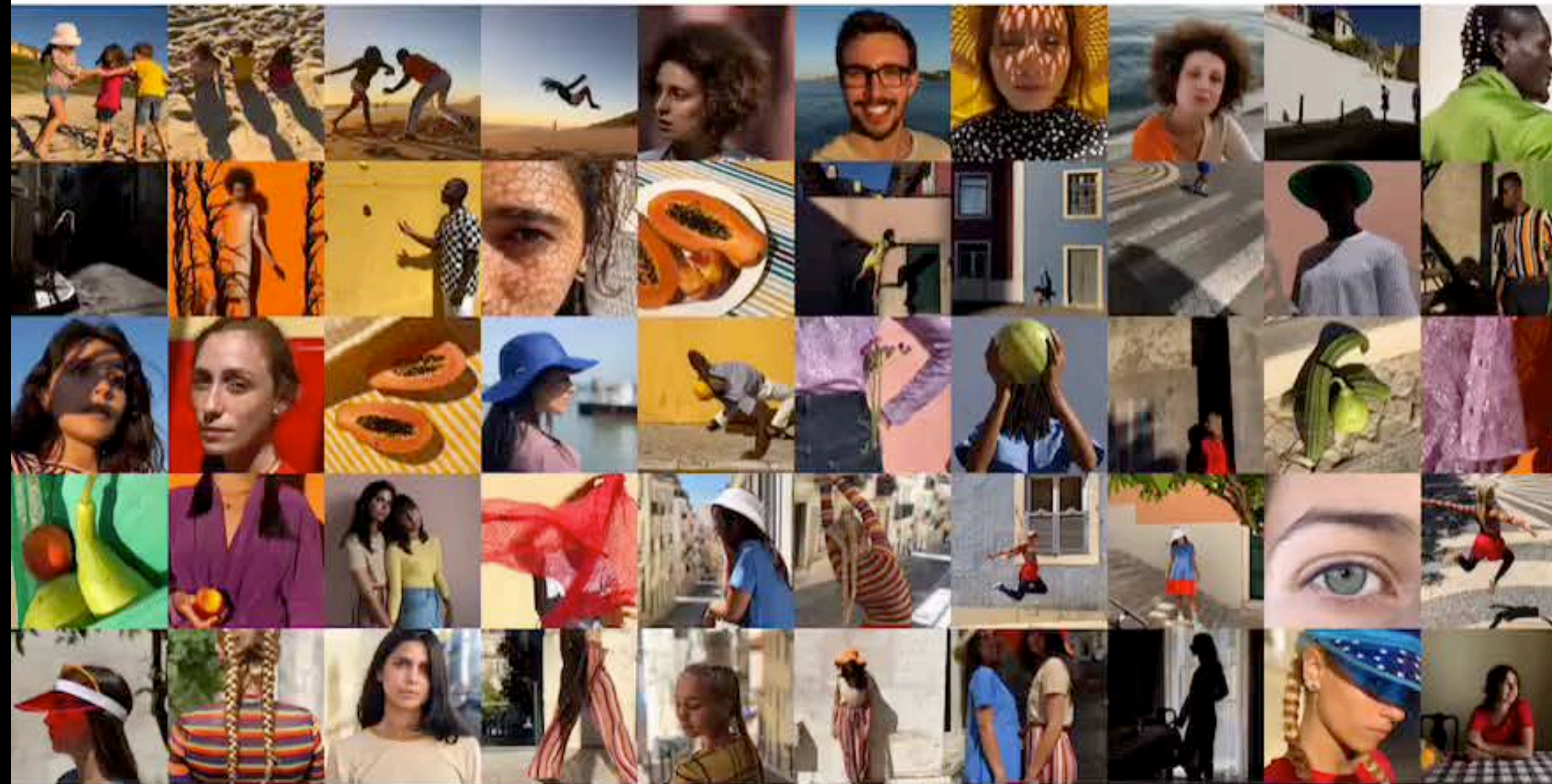
Essaouira

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Lisbon

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Photos



For You



Albums



Search

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< Years

Collections

Nashville

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Marrakech Médina

Aug 6, 2017 · Marrakech-Tensift-Al Haouz



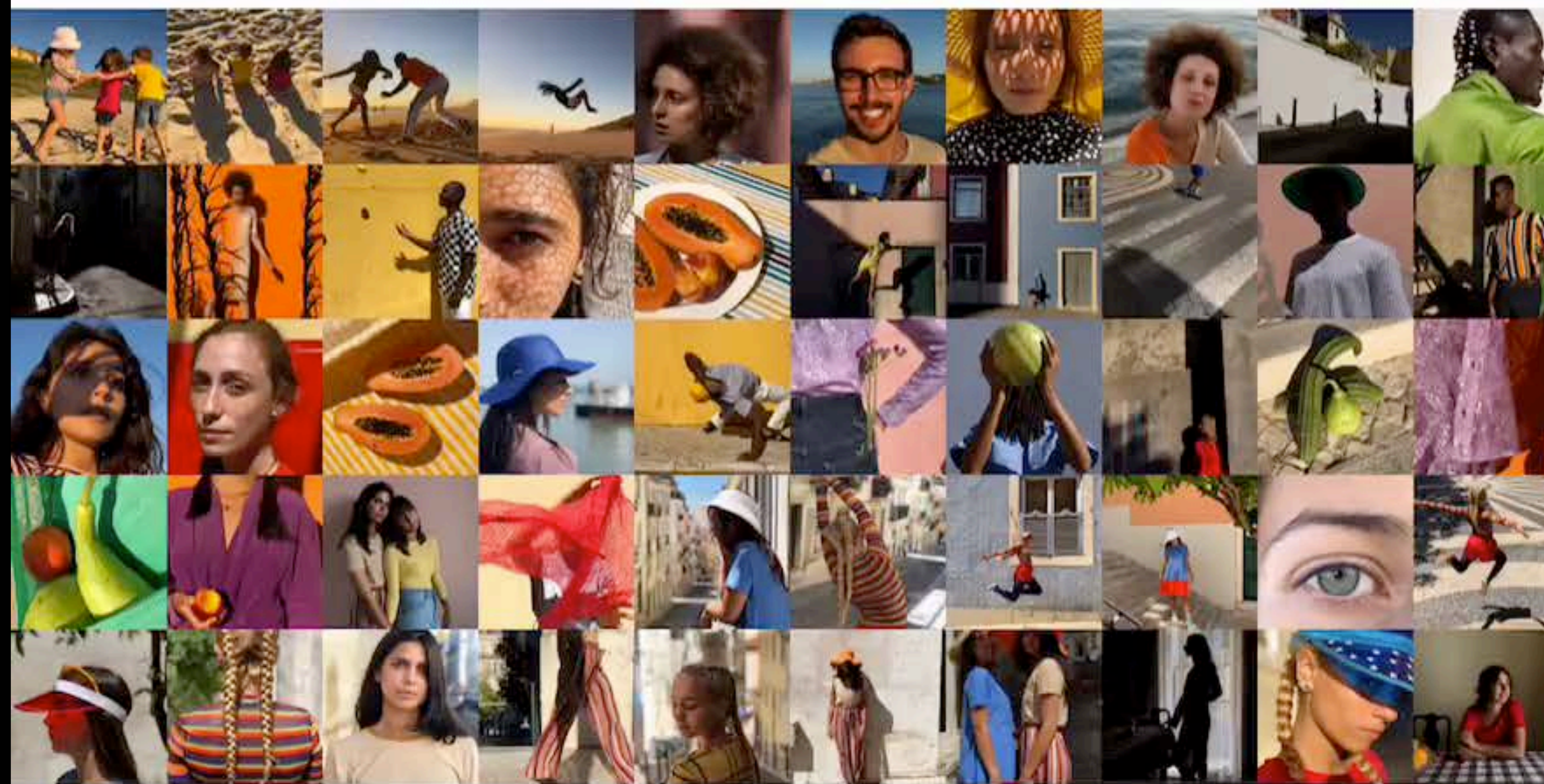
Essaouira

Aug 7, 2017 · Marrakech-Tensift-Al Haouz



Lisbon

Aug 19–21, 2017 · Lisbon



Photos



For You



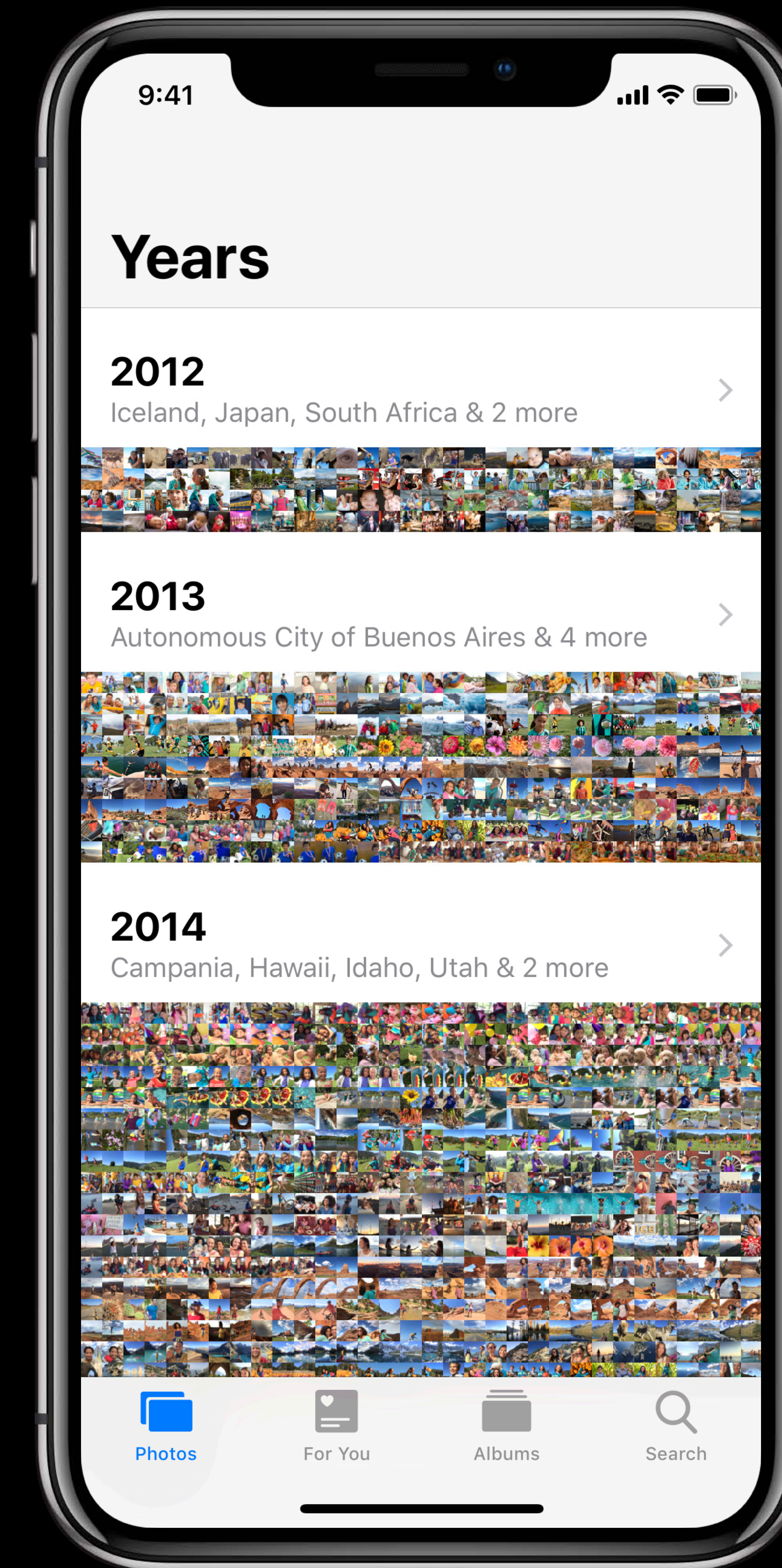
Albums



Search

Building Collections/Years

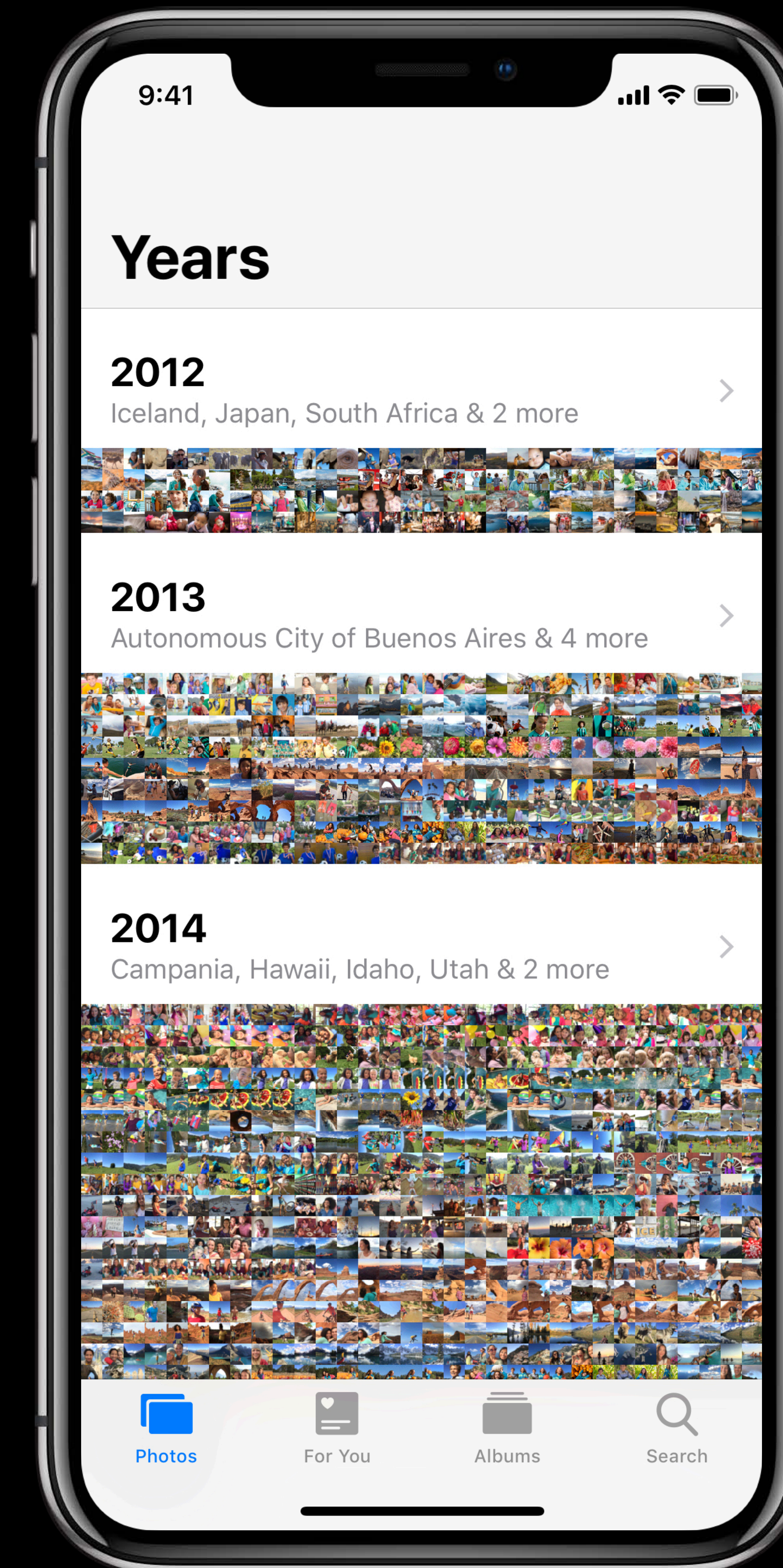
Complex view hierarchy



Building Collections/Years

Complex view hierarchy

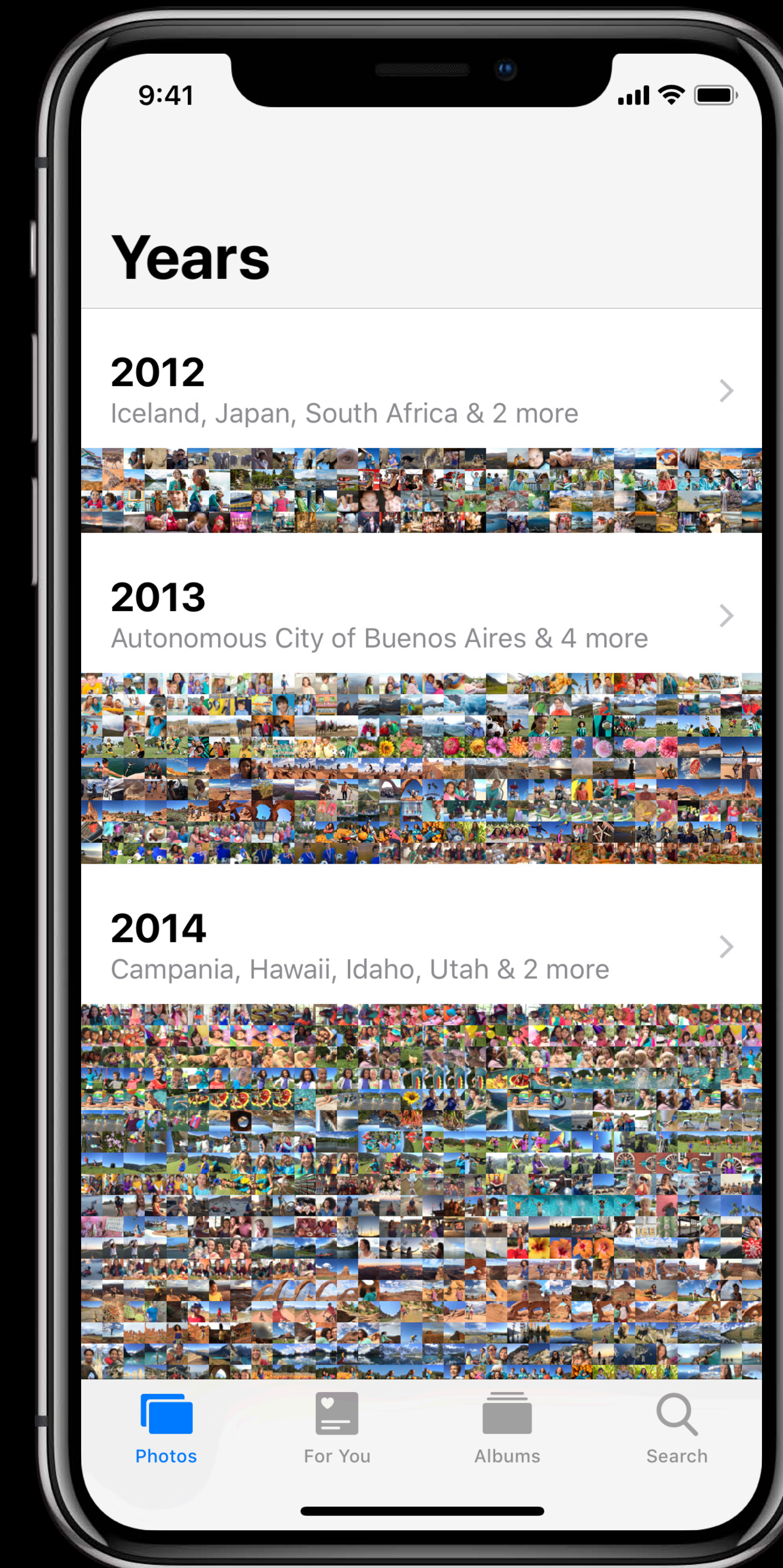
- Thousands of pictures displayed



Building Collections/Years

Complex view hierarchy

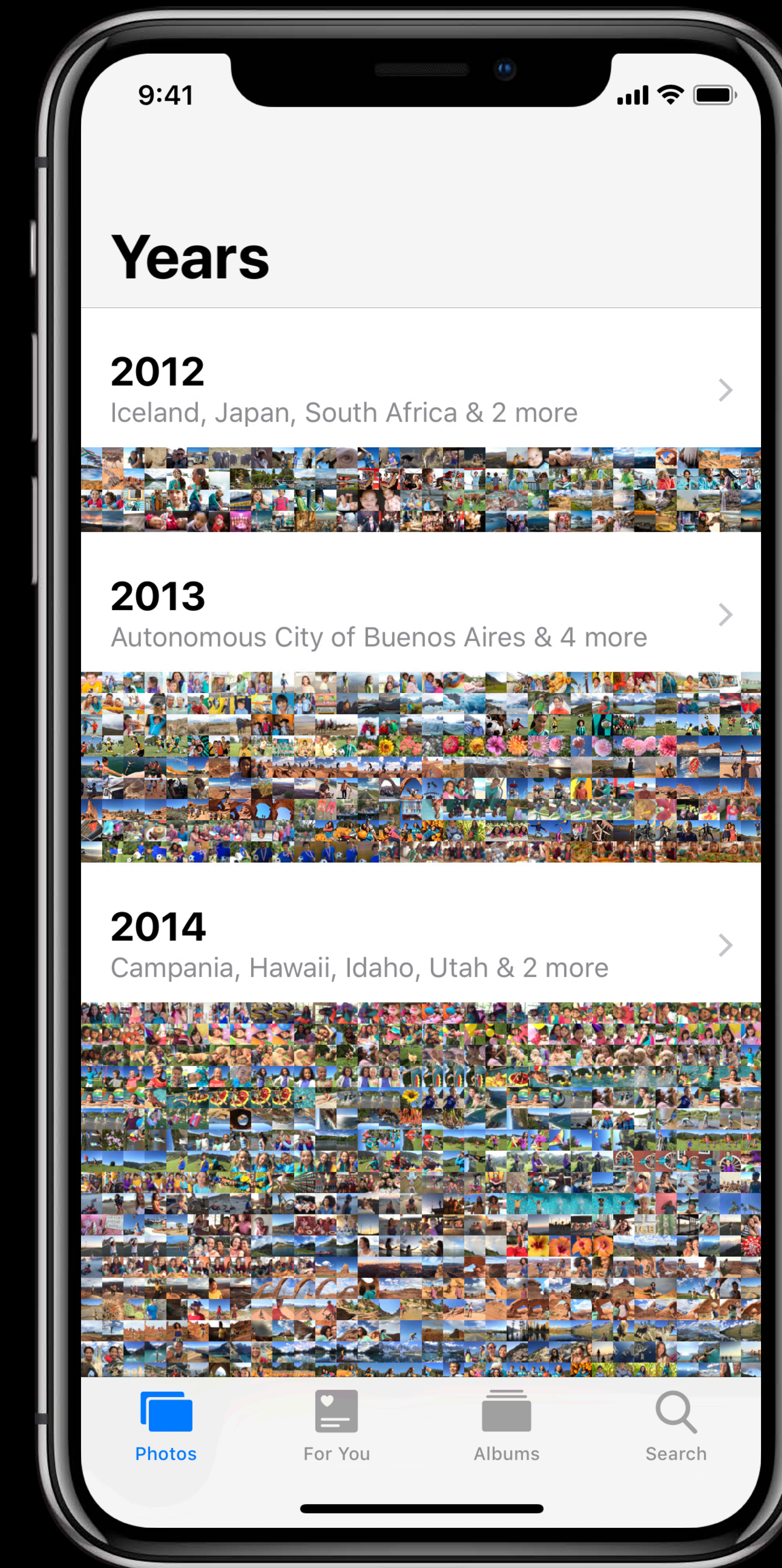
- Thousands of pictures displayed
- Live updates



Building Collections/Years

Complex view hierarchy

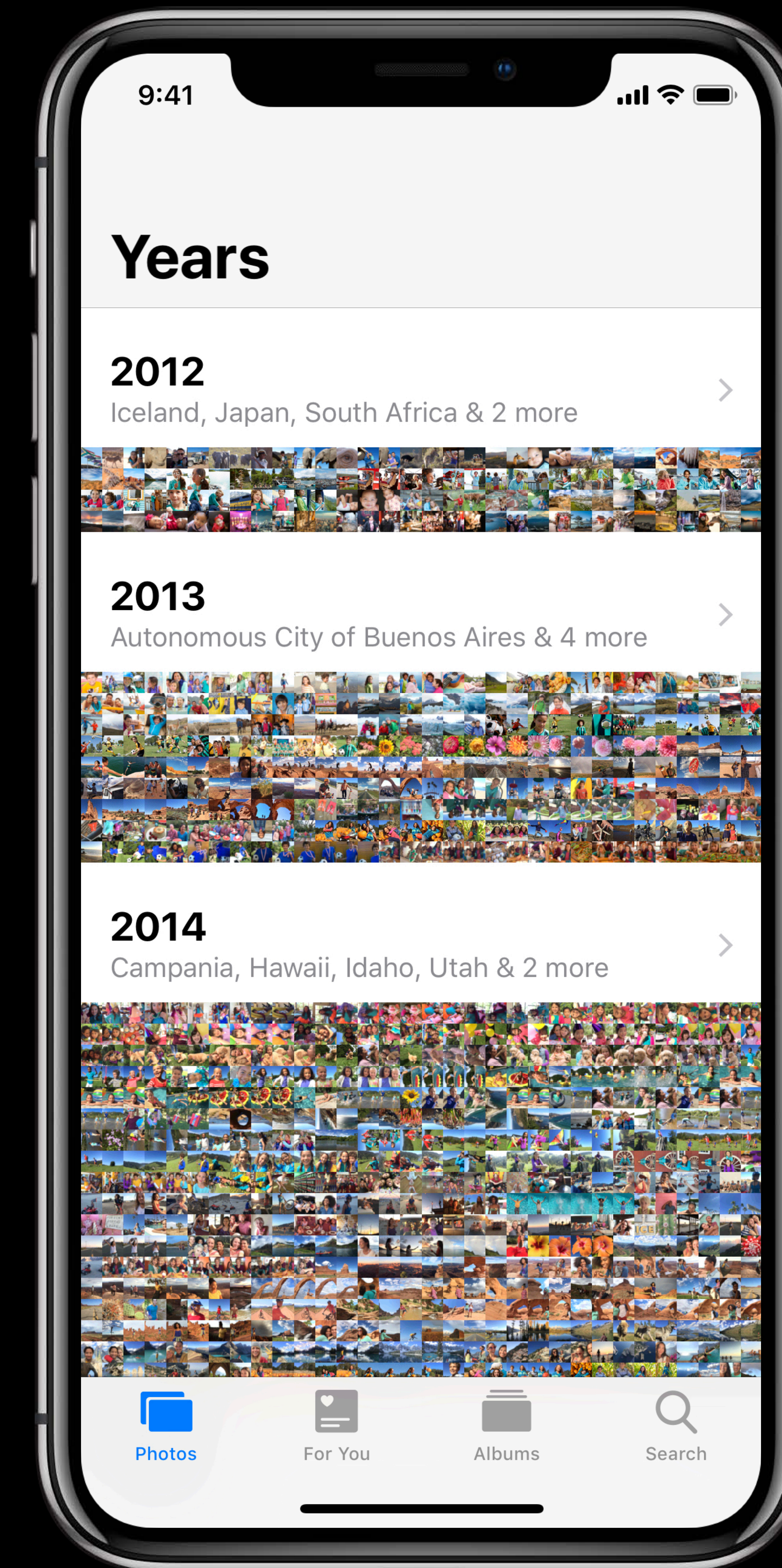
- Thousands of pictures displayed
- Live updates
- Animations



Building Collections/Years

Complex view hierarchy

- Thousands of pictures displayed
- Live updates
- Animations
- Gestures



Building Collections/Years

Goals

Building Collections/Years

Goals

No spinner

Building Collections/Years

Goals

No spinner

No placeholders

Building Collections/Years

Goals

No spinner

No placeholders

Smooth animations

Building Collections/Years

Principles

Building Collections/Years

Principles

Be lazy

Building Collections/Years

Principles

Be lazy

Be proactive

Building Collections/Years

Principles

Be lazy

Be proactive

Be constant

Building Collections/Years

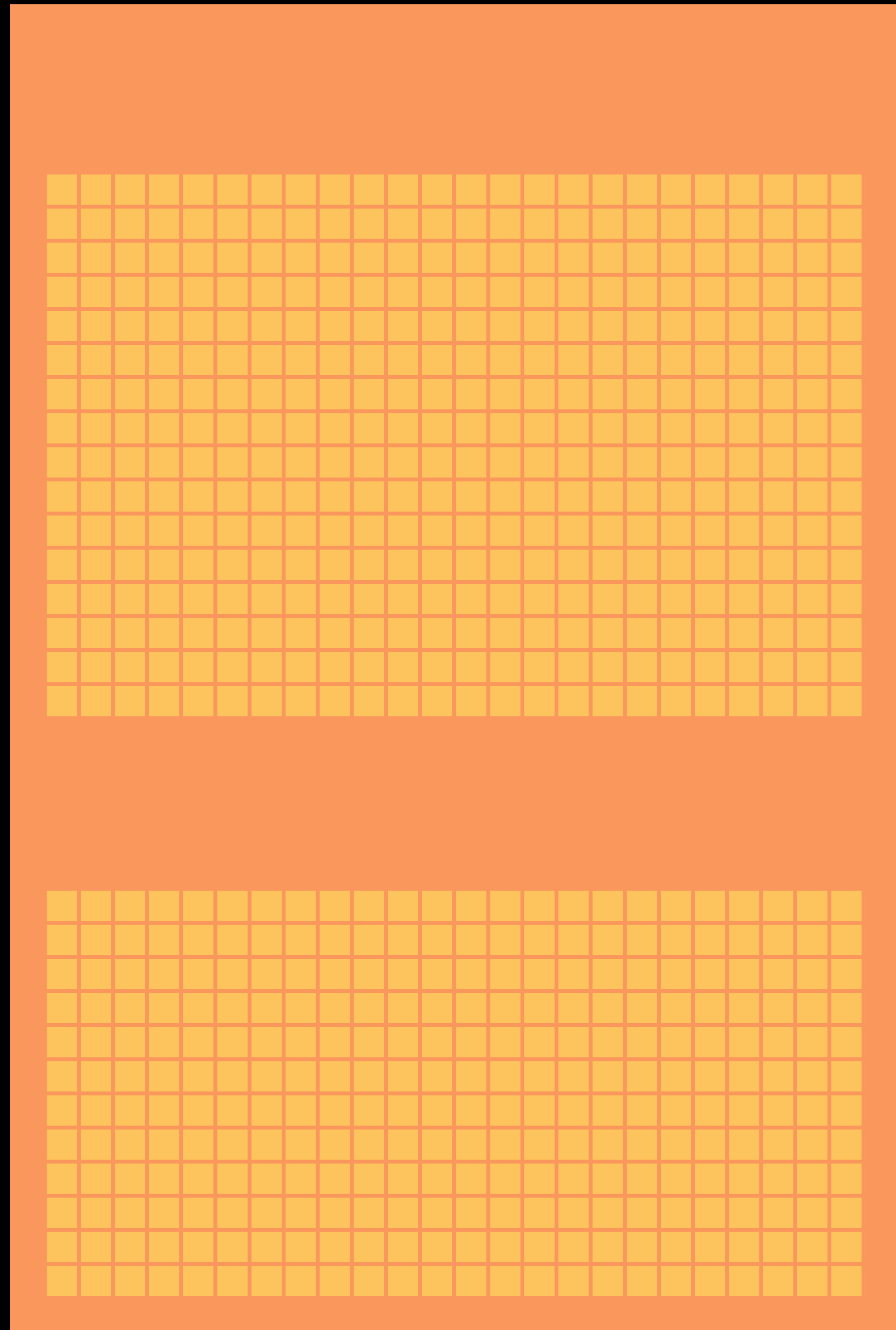
Principles

Be lazy

Be proactive

Be constant

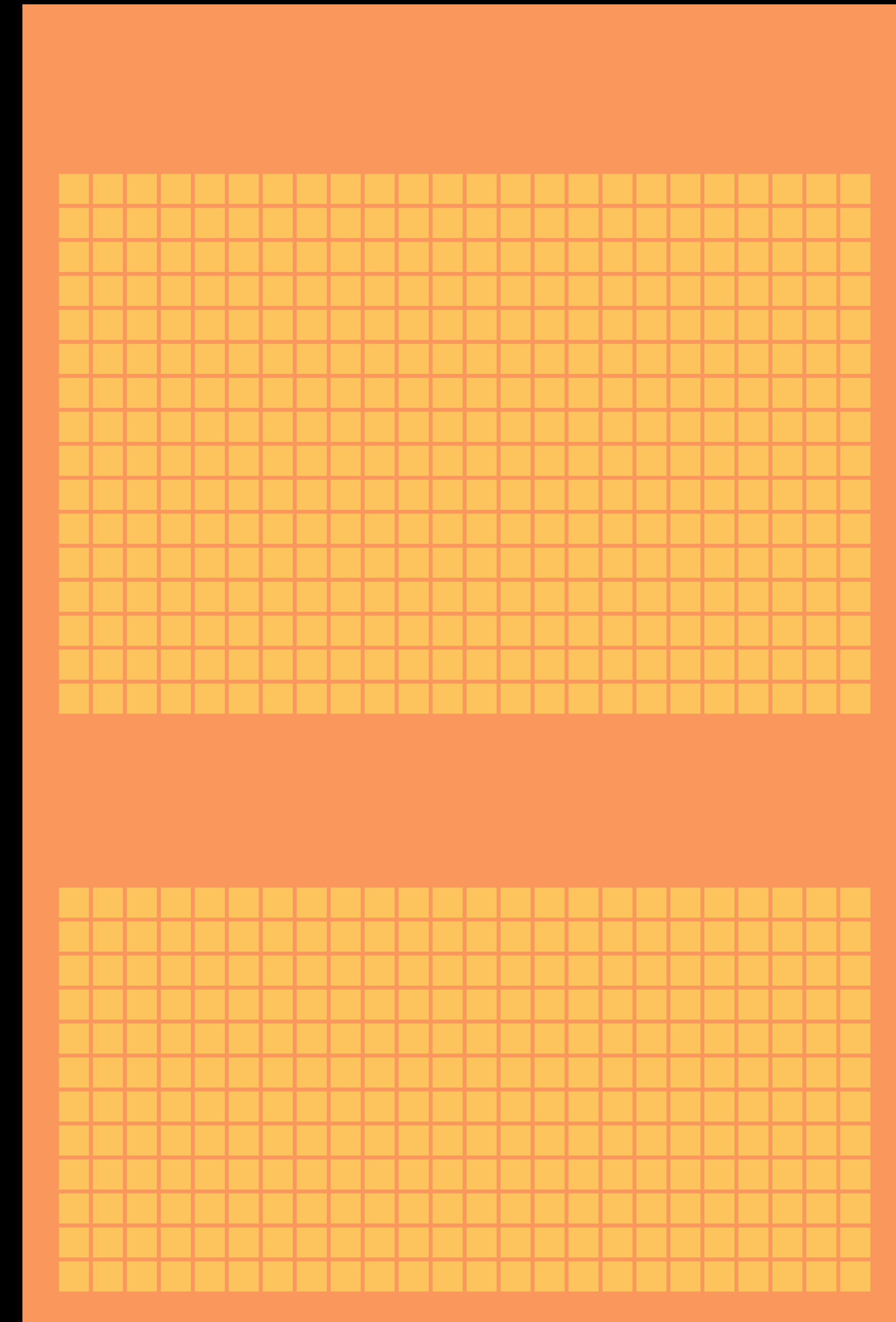
Be timely



Building Collections/Years

Basic Approach

UICollectionView with a cell for each items

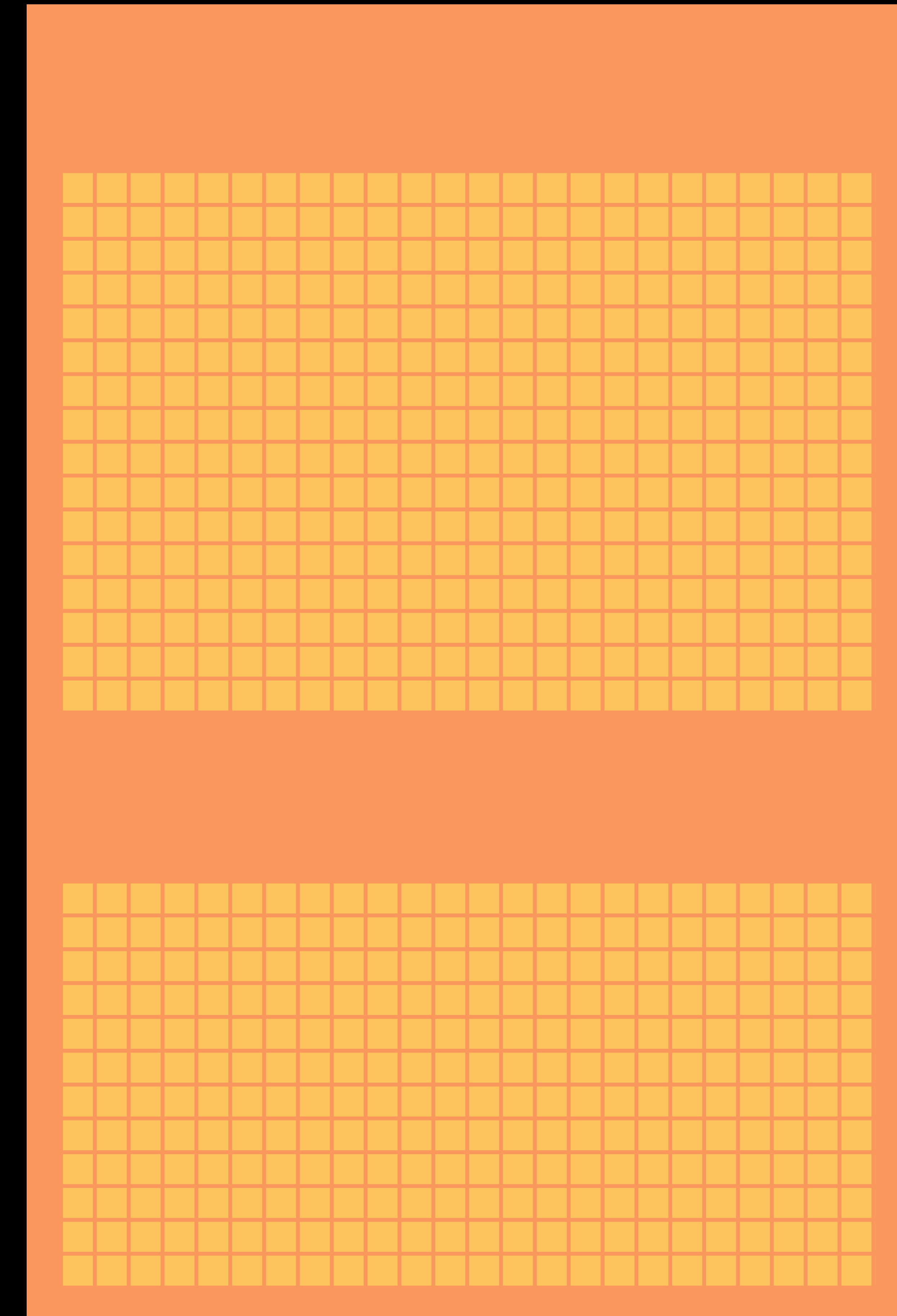


Building Collections/Years

Basic Approach

UICollectionView with a cell for each items

- Too many views/layers

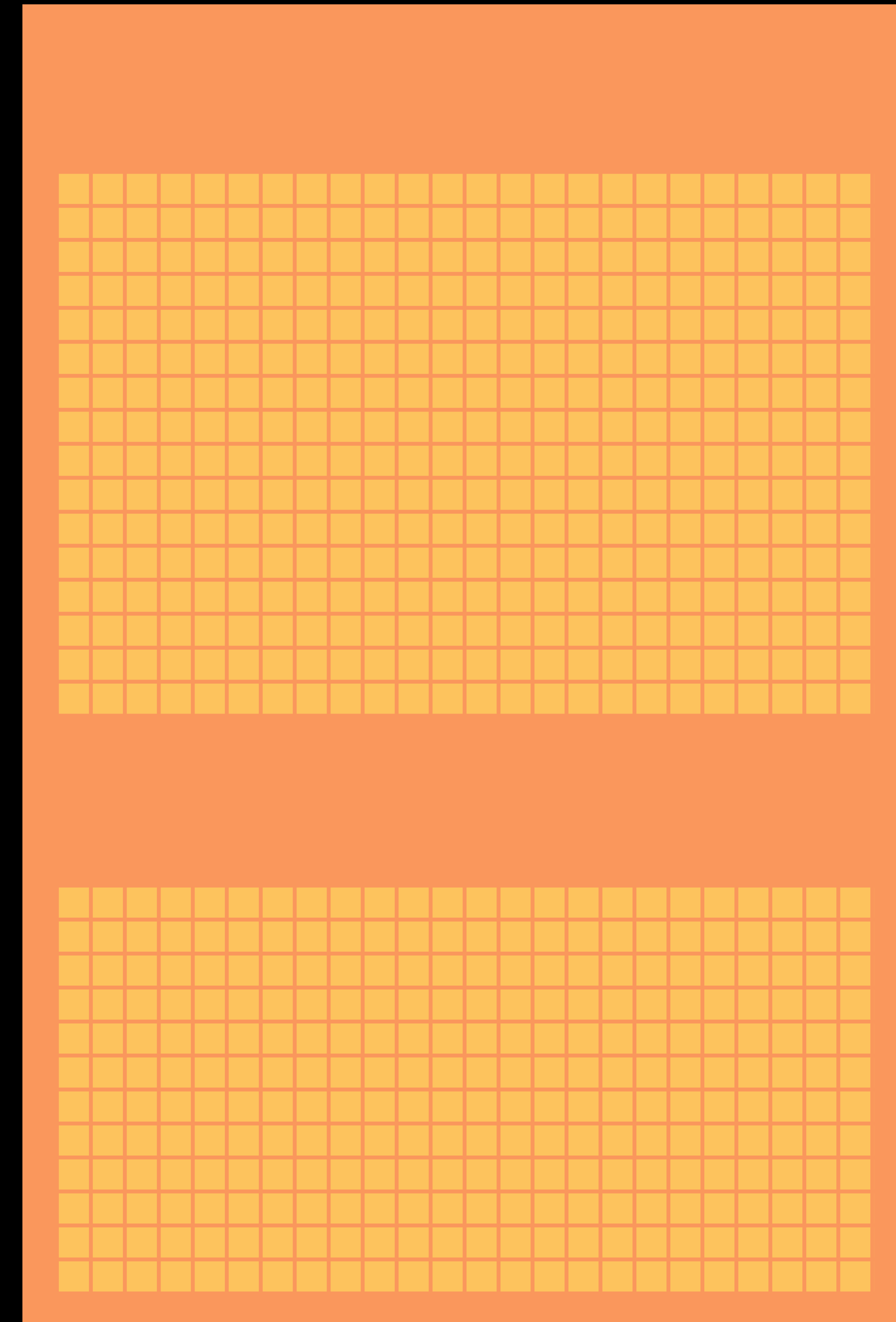


Building Collections/Years

Basic Approach

UICollectionView with a cell for each items

- Too many views/layers
- Layout complexity

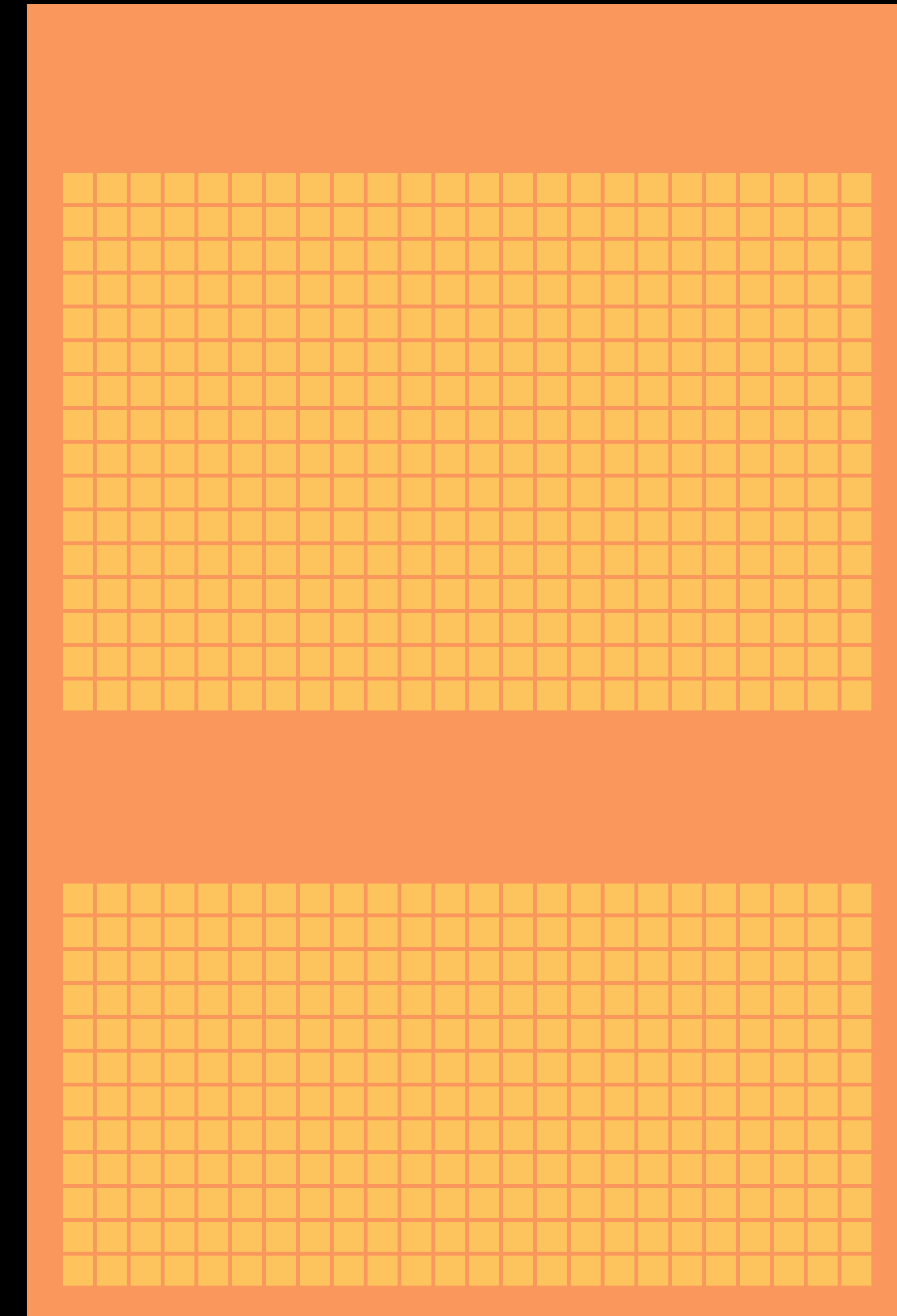


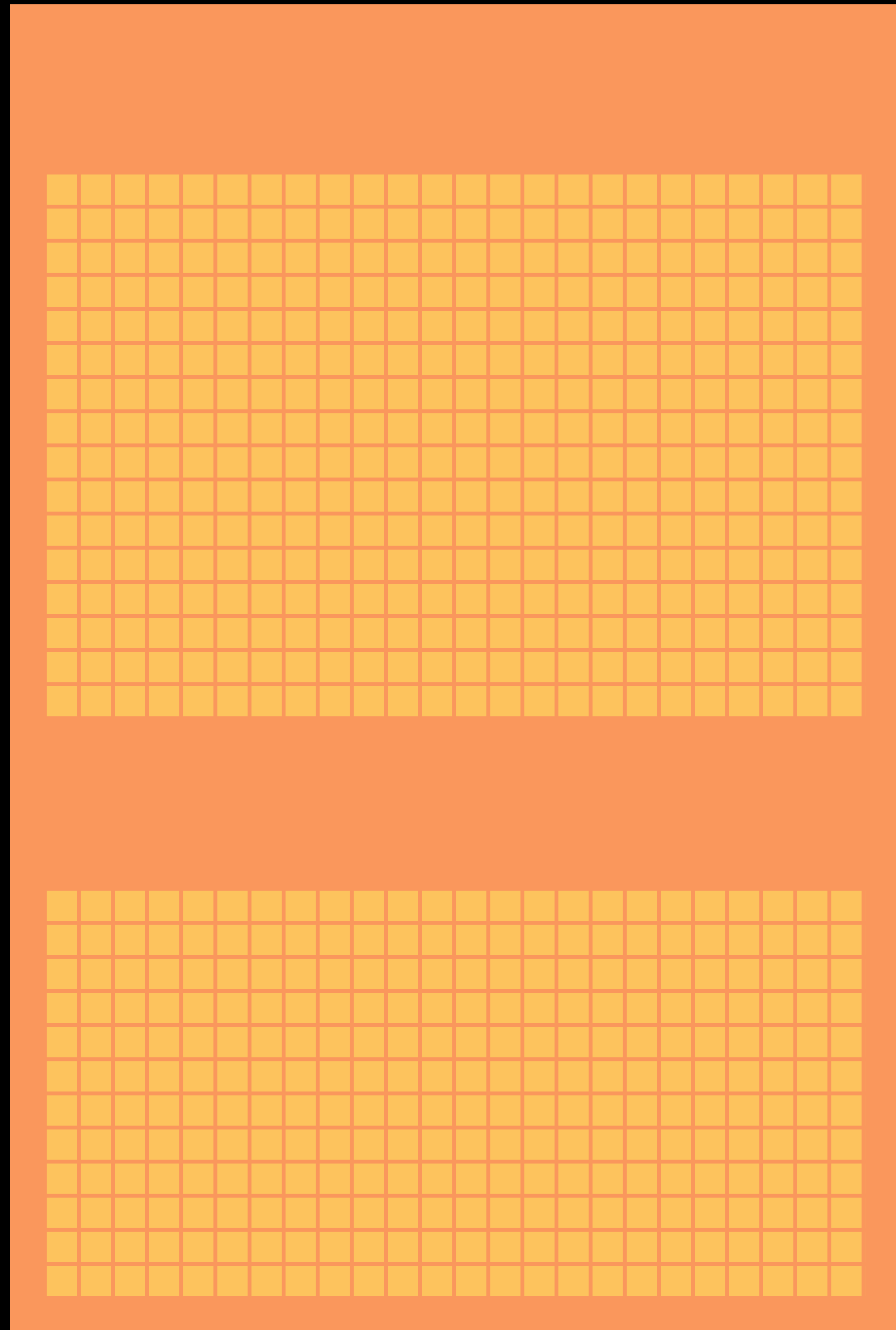
Building Collections/Years

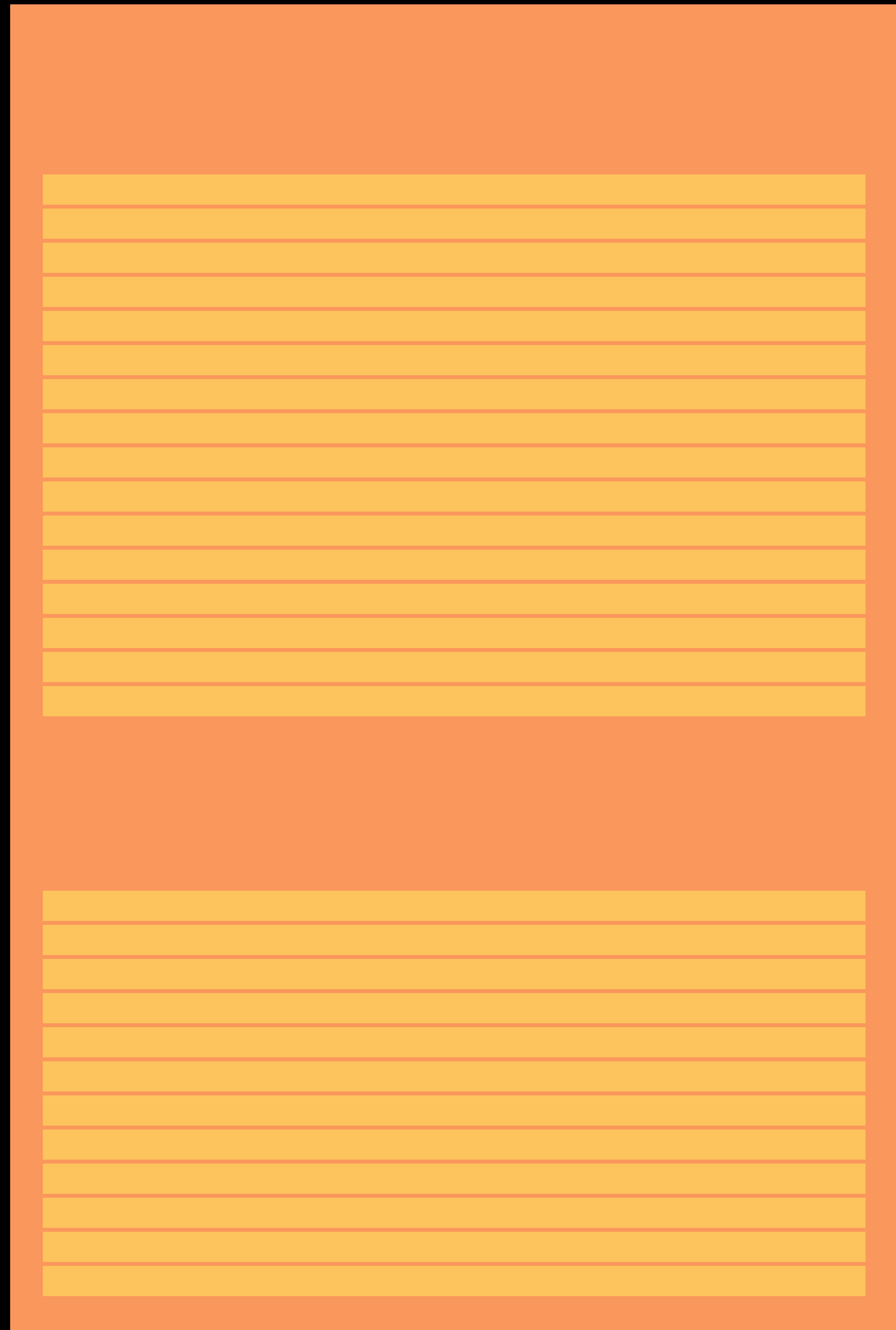
Basic Approach

UICollectionView with a cell for each items

- Too many views/layers
- Layout complexity
- Memory cost







Building Collections/Years

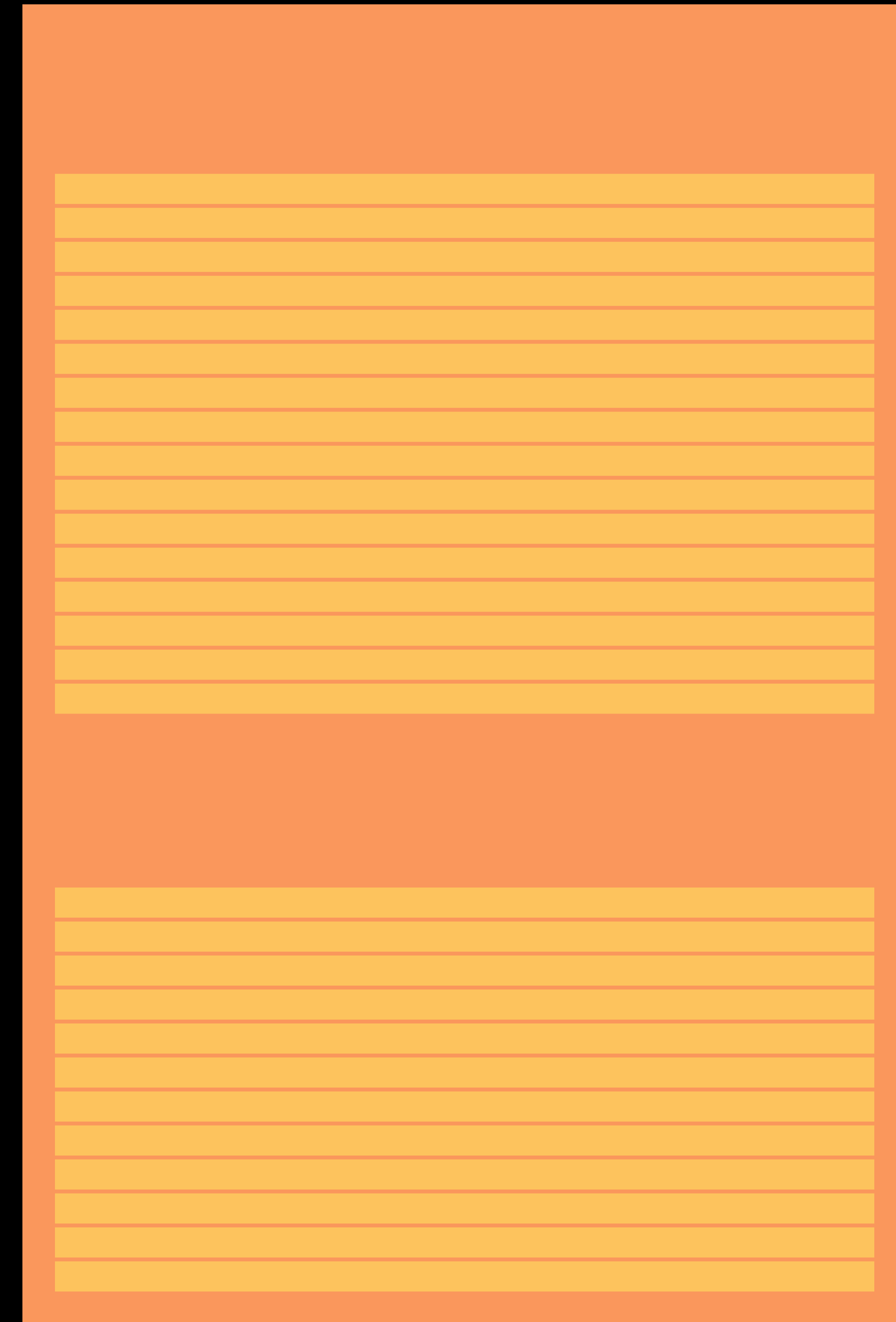
Atlasing Approach

The form consists of a vertical rectangle with a light orange background. It is divided into two main sections by a horizontal gap. Each section contains a series of horizontal lines for text entry. The top section has 15 lines, and the bottom section has 15 lines. The lines are a slightly darker shade of orange than the background.

Building Collections/Years

Atlasing Approach

Rendered strips

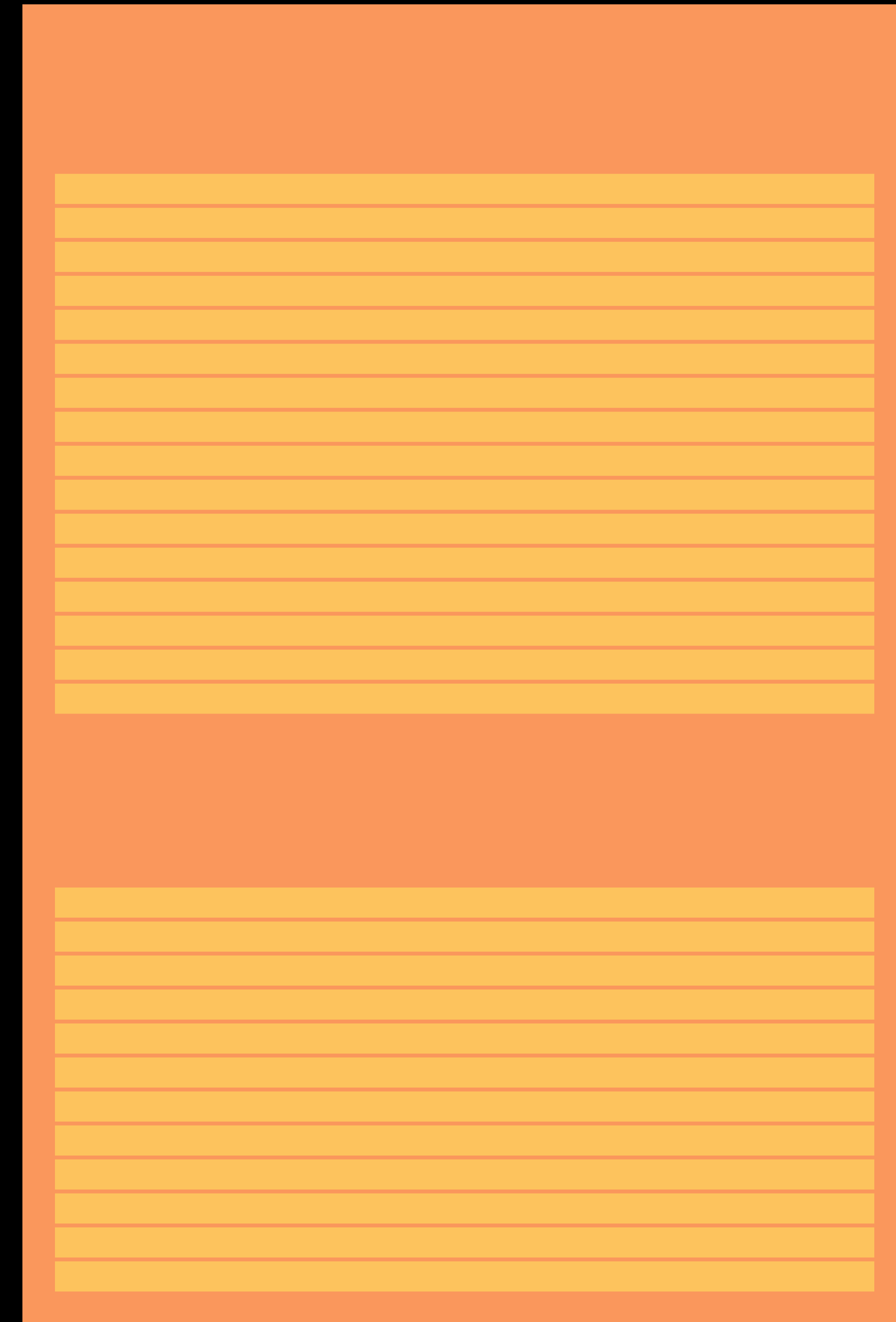


Building Collections/Years

Atlasing Approach

Rendered strips

Displayed as a single image



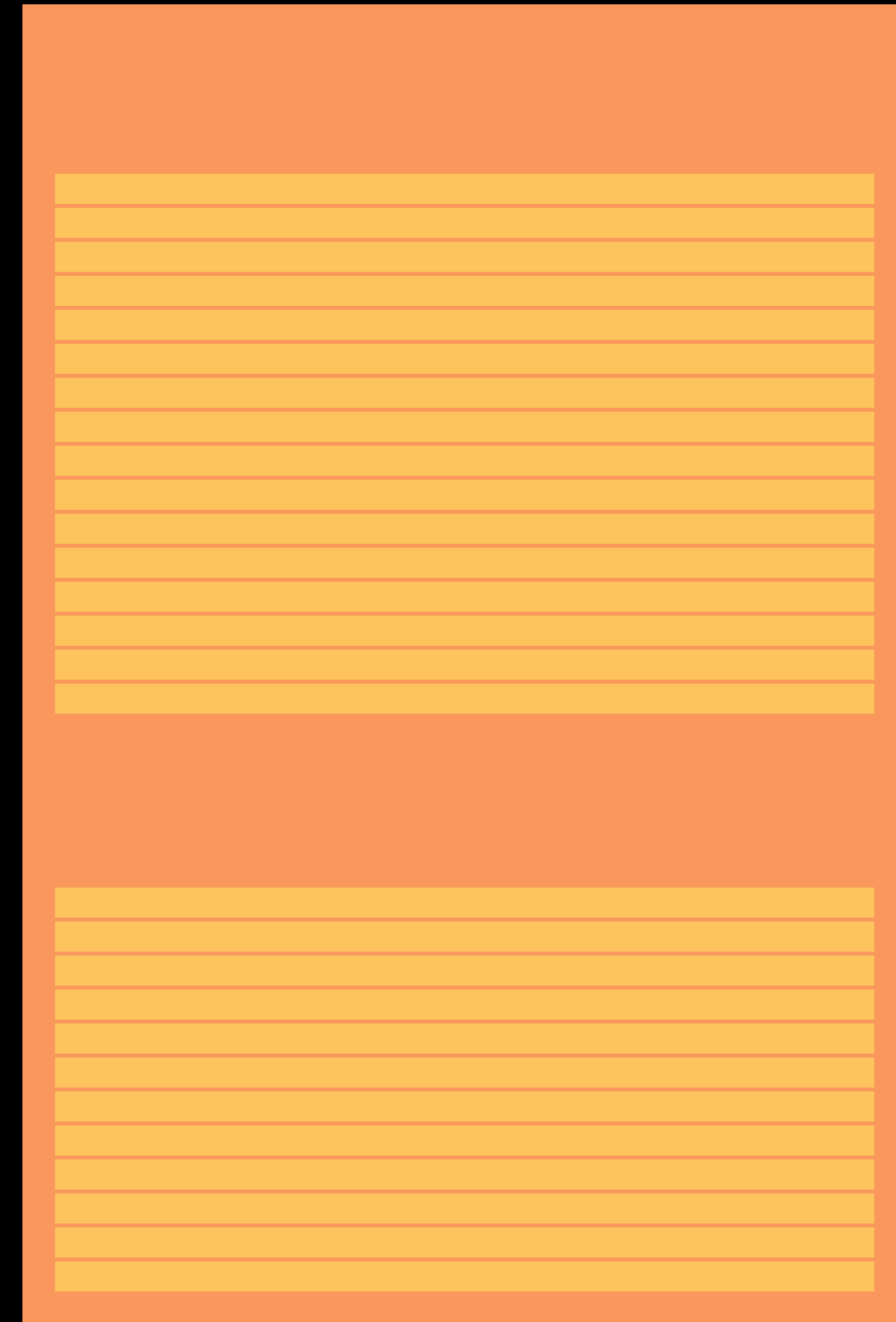
Building Collections/Years

Atlasing Approach

Rendered strips

Displayed as a single image

Generated/Cached on the fly



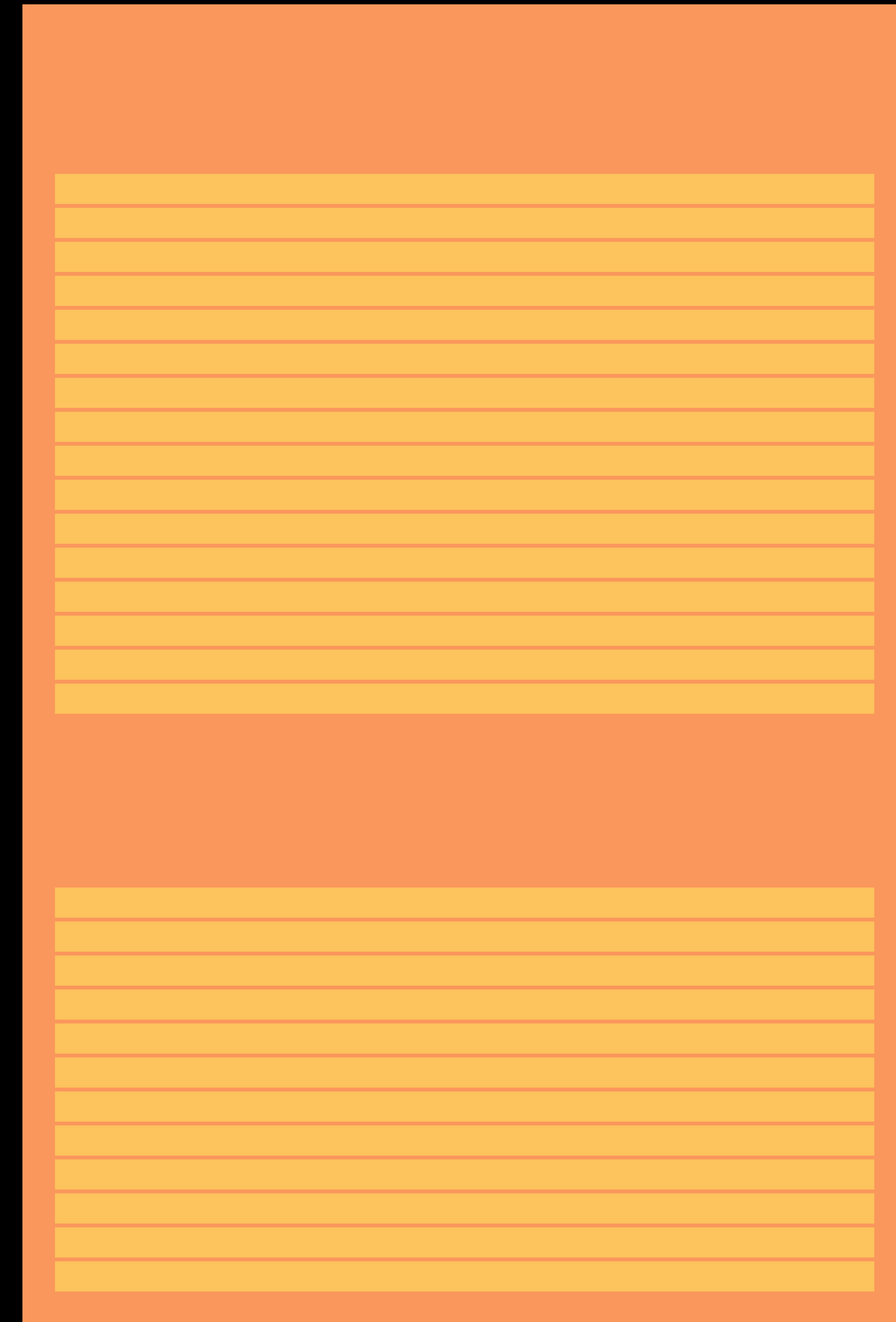
Building Collections/Years

Atlasing Approach

Rendered strips

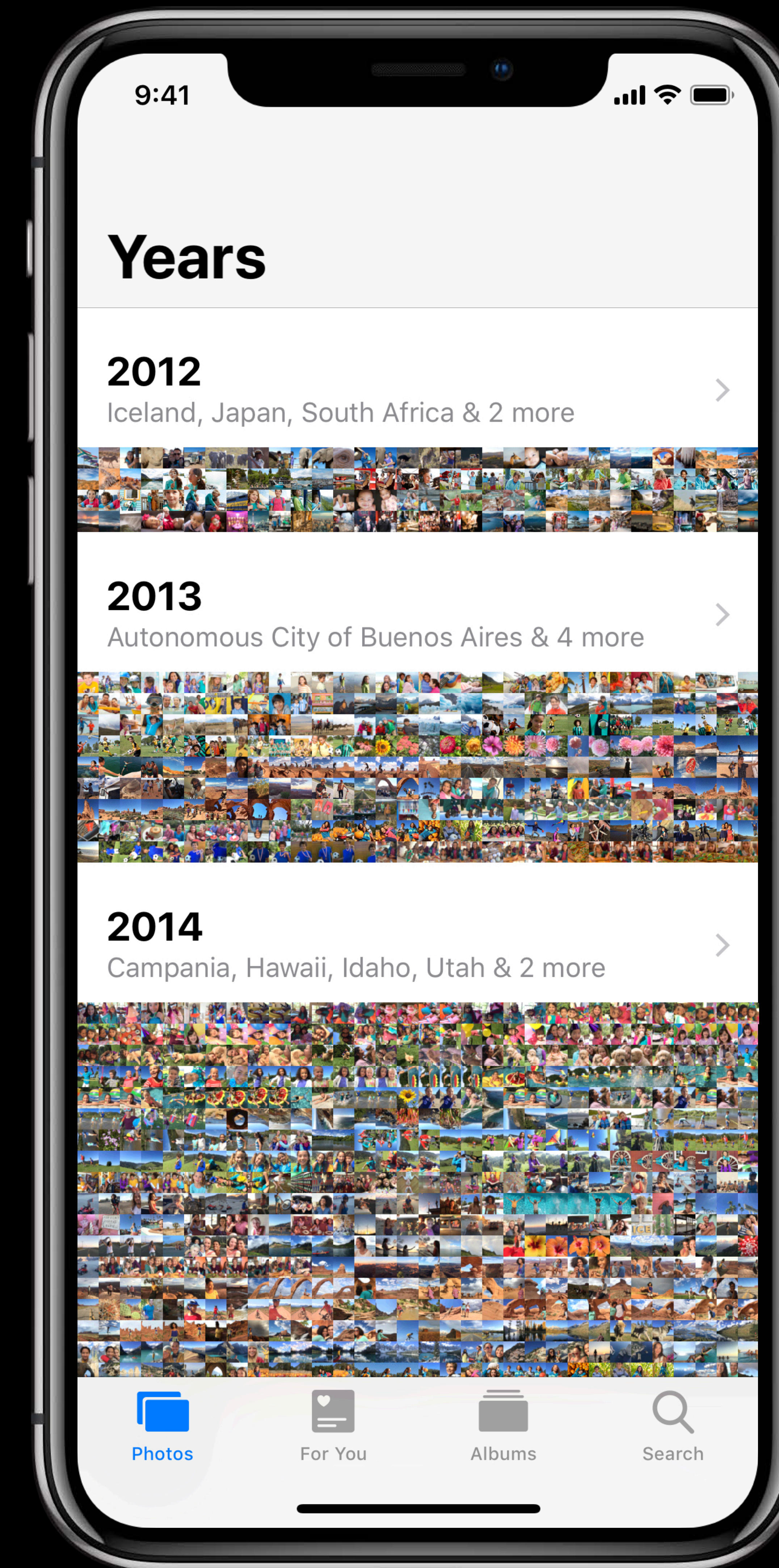
Displayed as a single image

Generated/Cached on the fly



Building Collections/Years

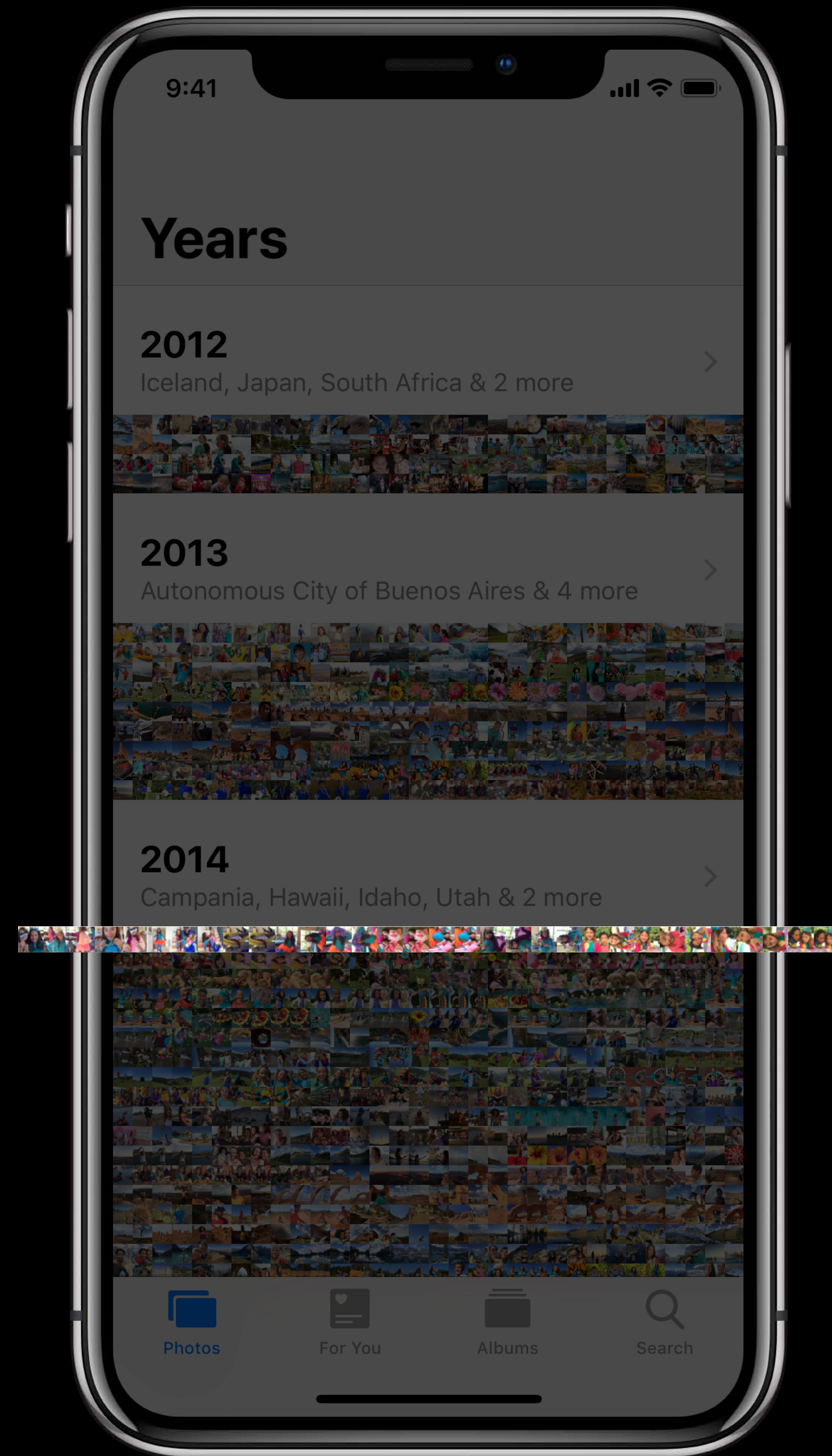
Atlasing Approach



Building Collections/Years

Atlasing Approach

Render multiple images into in a single one



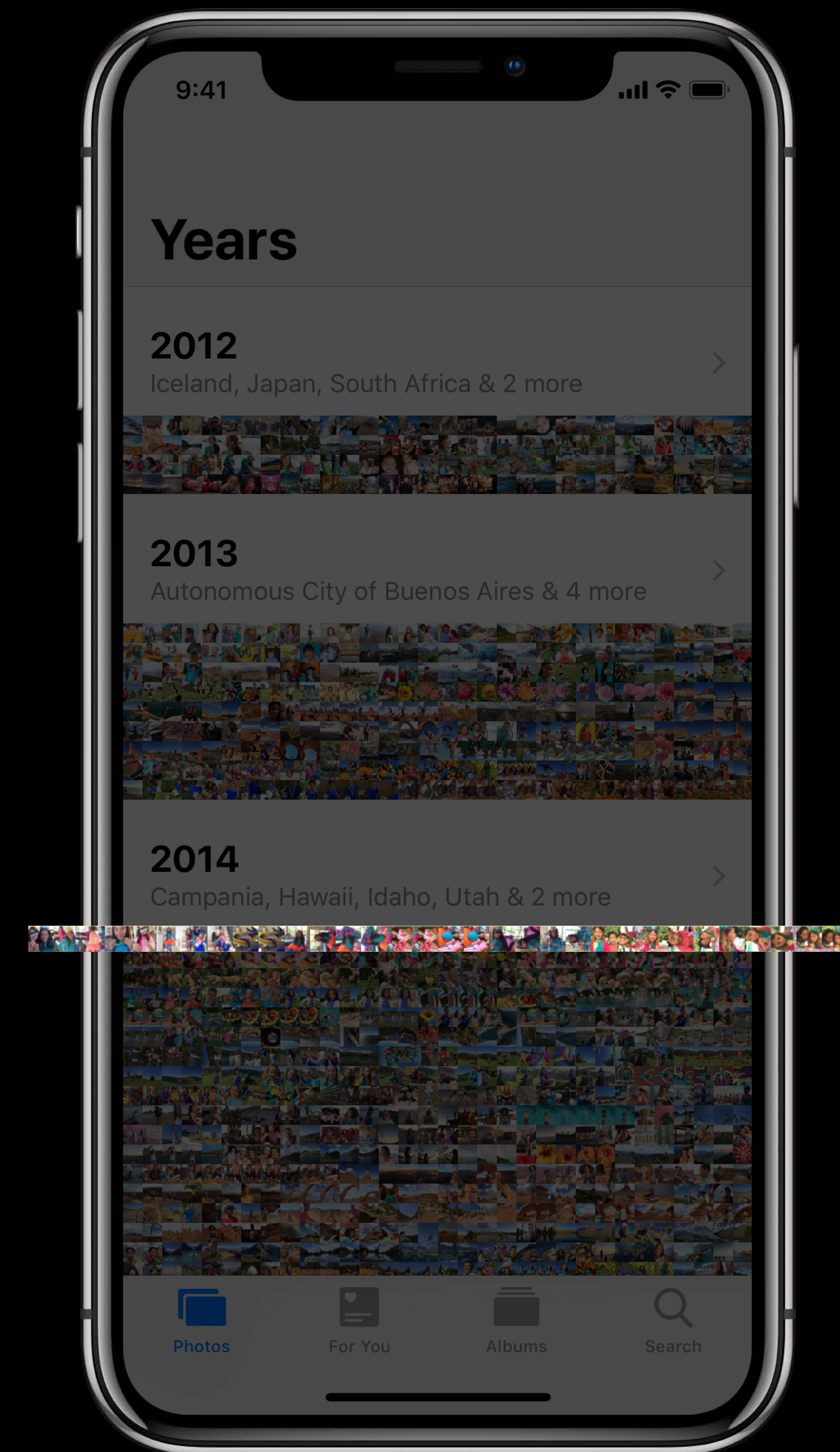
Building Collections/Years

Atlasing Approach

Render multiple images into in a single one

Fewer

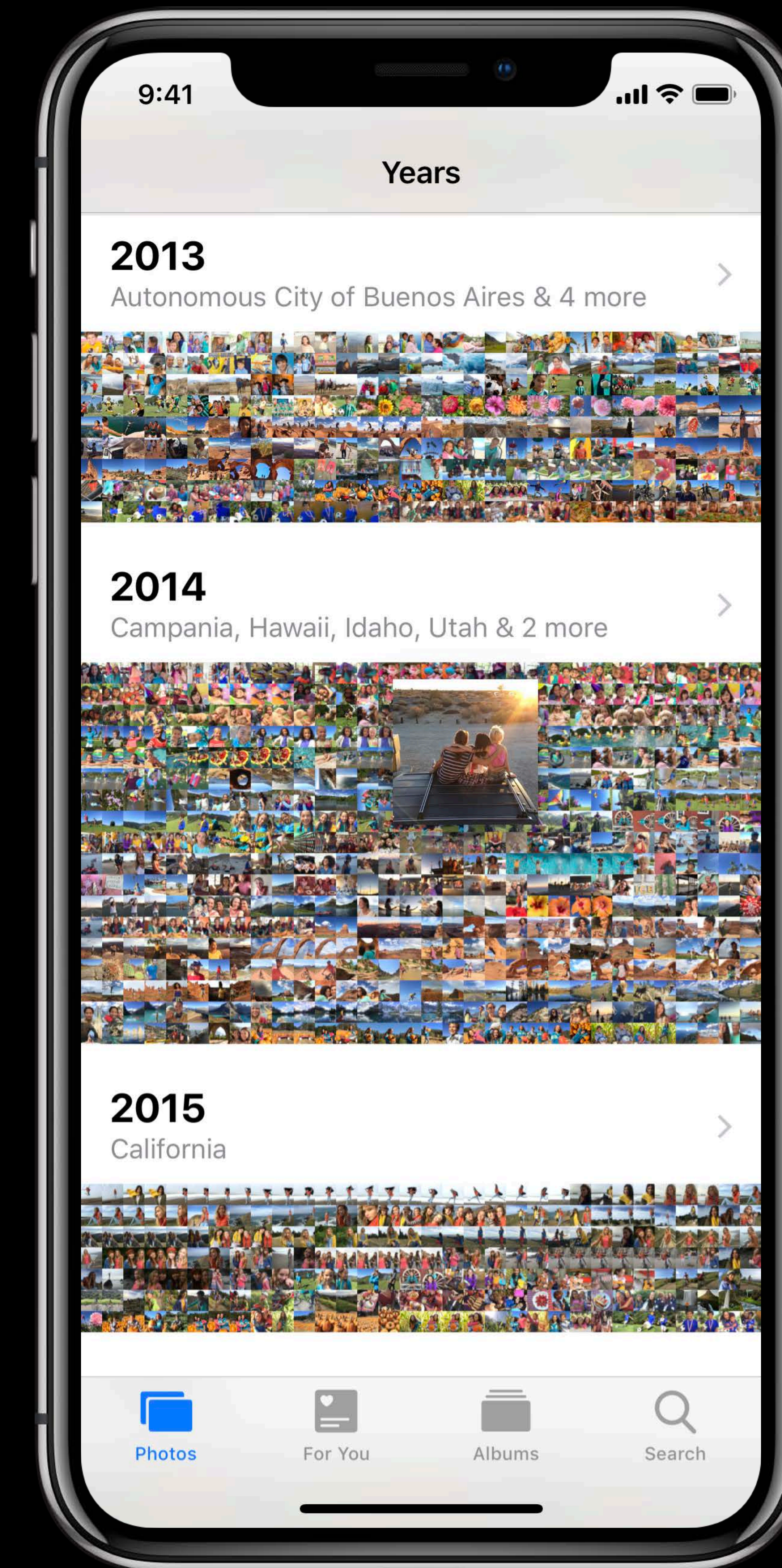
- Cells
- Layers
- Objects



Building Collections/Years

Atlasing Approach Trade-off

Long Press/3D Touch Preview

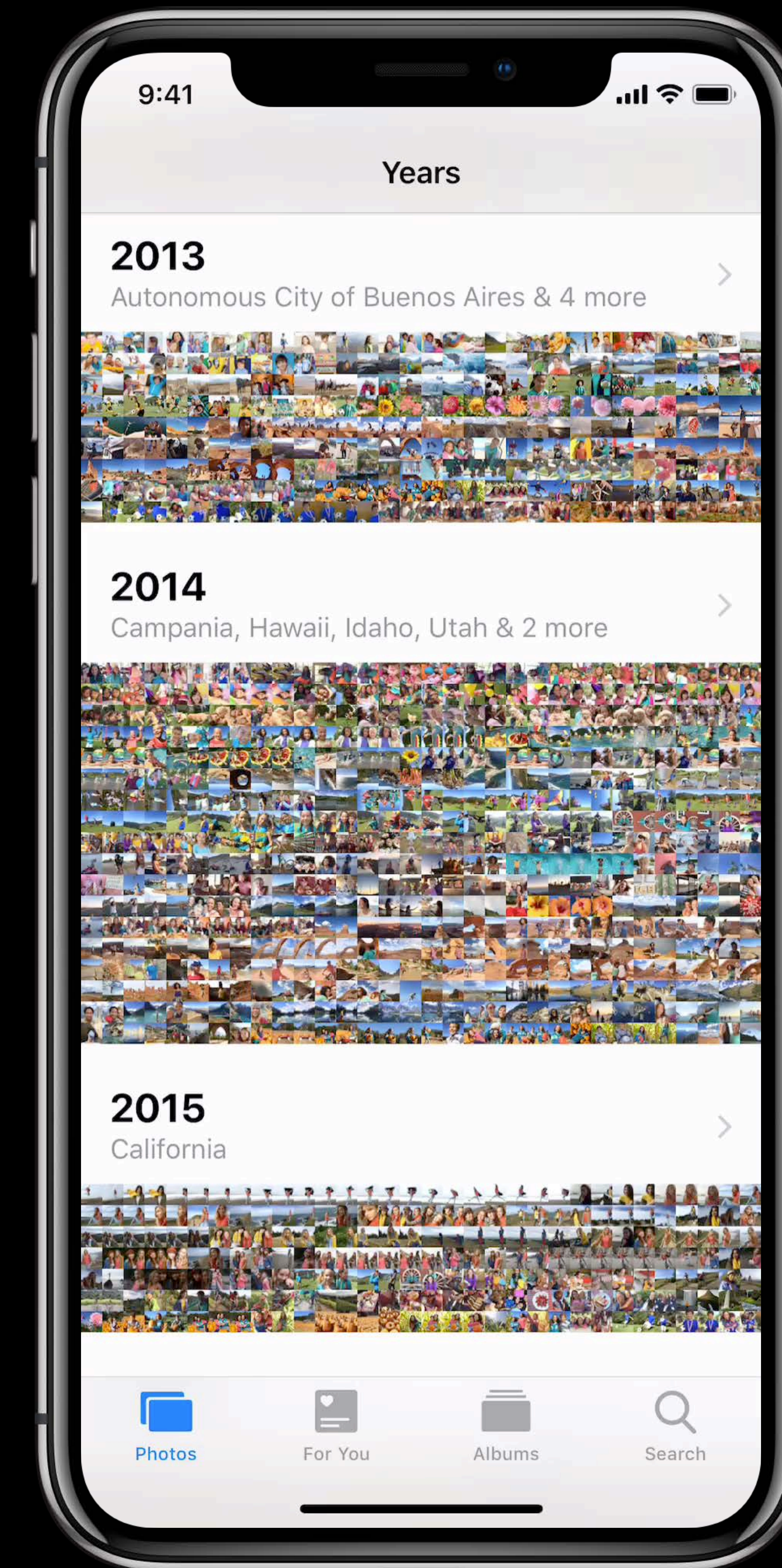


Building Collections/Years

Atlasing Approach Trade-off

Long Press/3D Touch Preview

- Gesture handlers

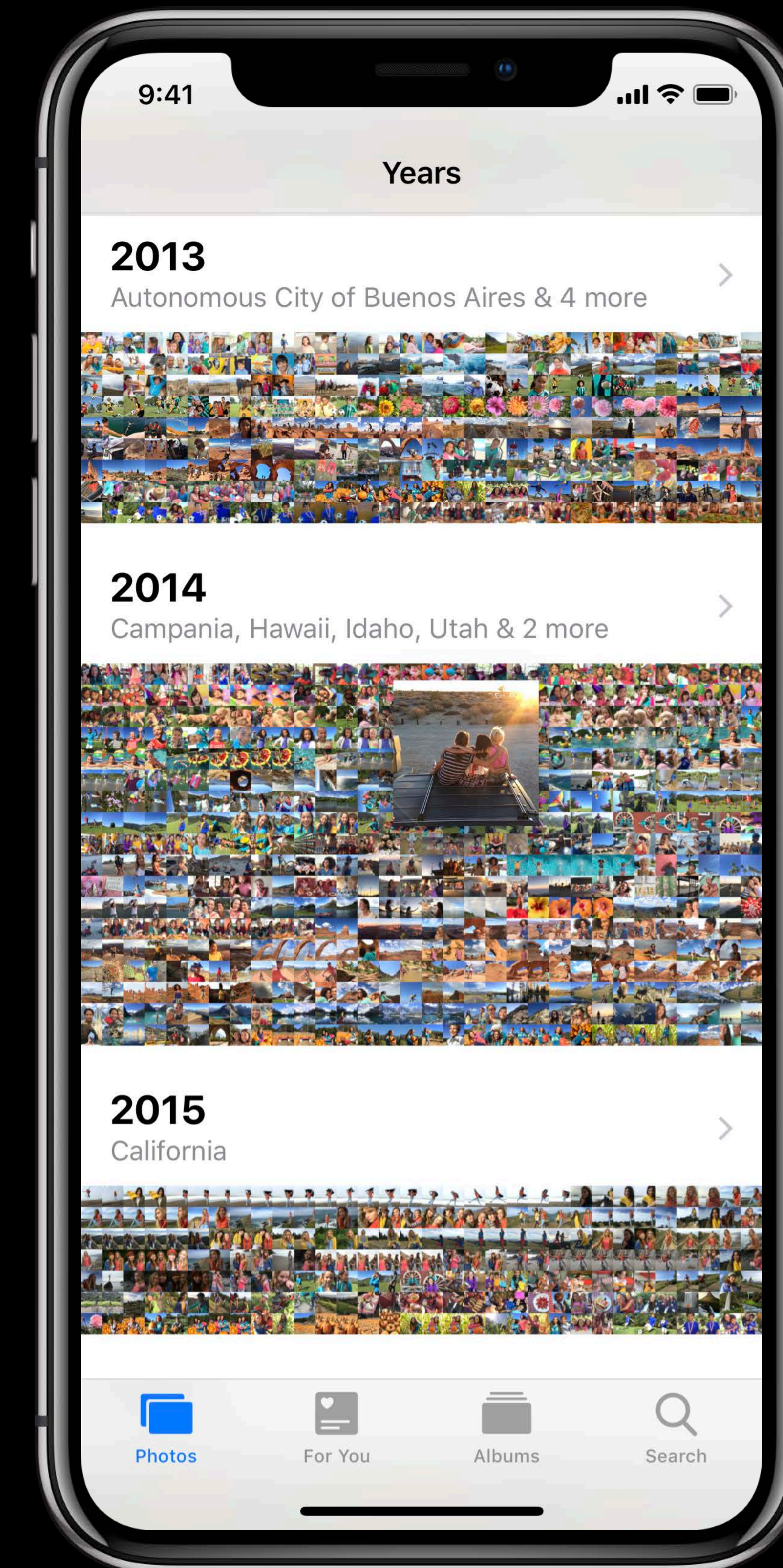


Building Collections/Years

Atlasing Approach Trade-off

Long Press/3D Touch Preview

- Gesture handlers
- Mapping with individual items and rendered strips



Why generating them on the fly?

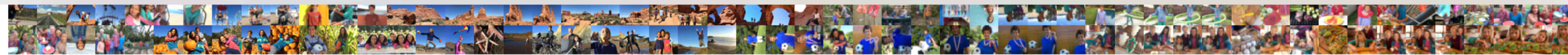
Live updates

View sizes

Years

2013

Autonomous City of Buenos Aires, Hawaii, Magallanes and Antartica Chilena, Arizona & 1 more



2014

Campania, Hawaii, Idaho, Utah, California & Alberta



 Photos

 For You

 Albums

 Search

9:41



Years

2012

Iceland, Japan, South Africa & 2 more



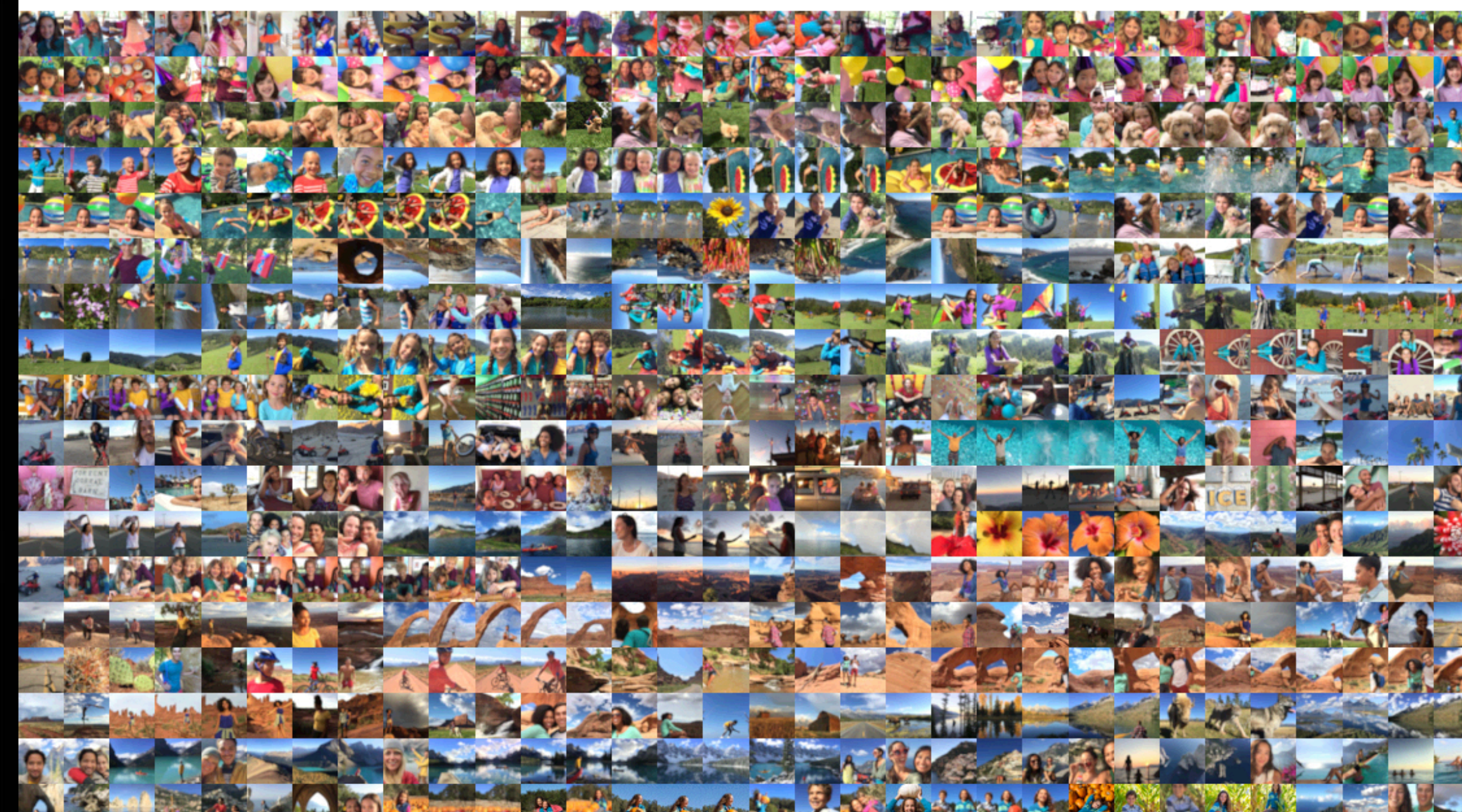
2013

Autonomous City of Buenos Aires & 4 more

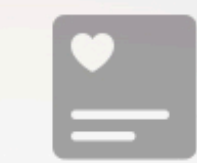


2014

Campania, Hawaii, Idaho, Utah & 2 more



Photos



For You



Albums



Search

Why not generating the whole section?

9:41



Years

2014

Campania, Hawaii, Idaho, Utah & 2 more



2015

California



2016

Hong Kong, New Jersey, Tennessee & 2 more



2017 – 2018

Nashville, Santa Monica, Essaouira & 3 more



Photos



For You



Albums



Search

9:41



Years

2014

Campania, Hawaii, Idaho, Utah & 2 more



2015

California



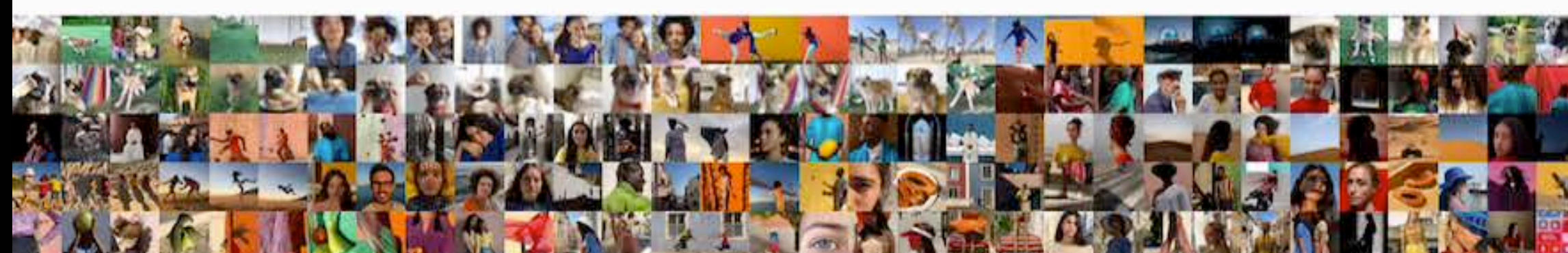
2016

Hong Kong, New Jersey, Tennessee & 2 more



2017 – 2018

Nashville, Santa Monica, Essaouira & 3 more



Photos



For You



Albums



Search

Think about the layout cost
of your view hierarchy

Measure the layout cost
of your view hierarchy

Always think about performance

More Information

<https://developer.apple.com/wwdc18/407>

PhotoKit & Photos Extensions Lab

Technology Lab 3

Thursday 3:00PM

Power and Performance Lab

Technology Lab 9

Friday 9:00AM

Profiling and Debugging Lab

Technology Lab 10

Friday 9:00AM

 **WWDC18**