

CCIS

كلية علوم الحاسب والمعلومات
COLLEGE OF COMPUTER &
INFORMATION SCIENCES



Flutter

جامعة الأمير سلطان
PRINCE SULTAN
UNIVERSITY



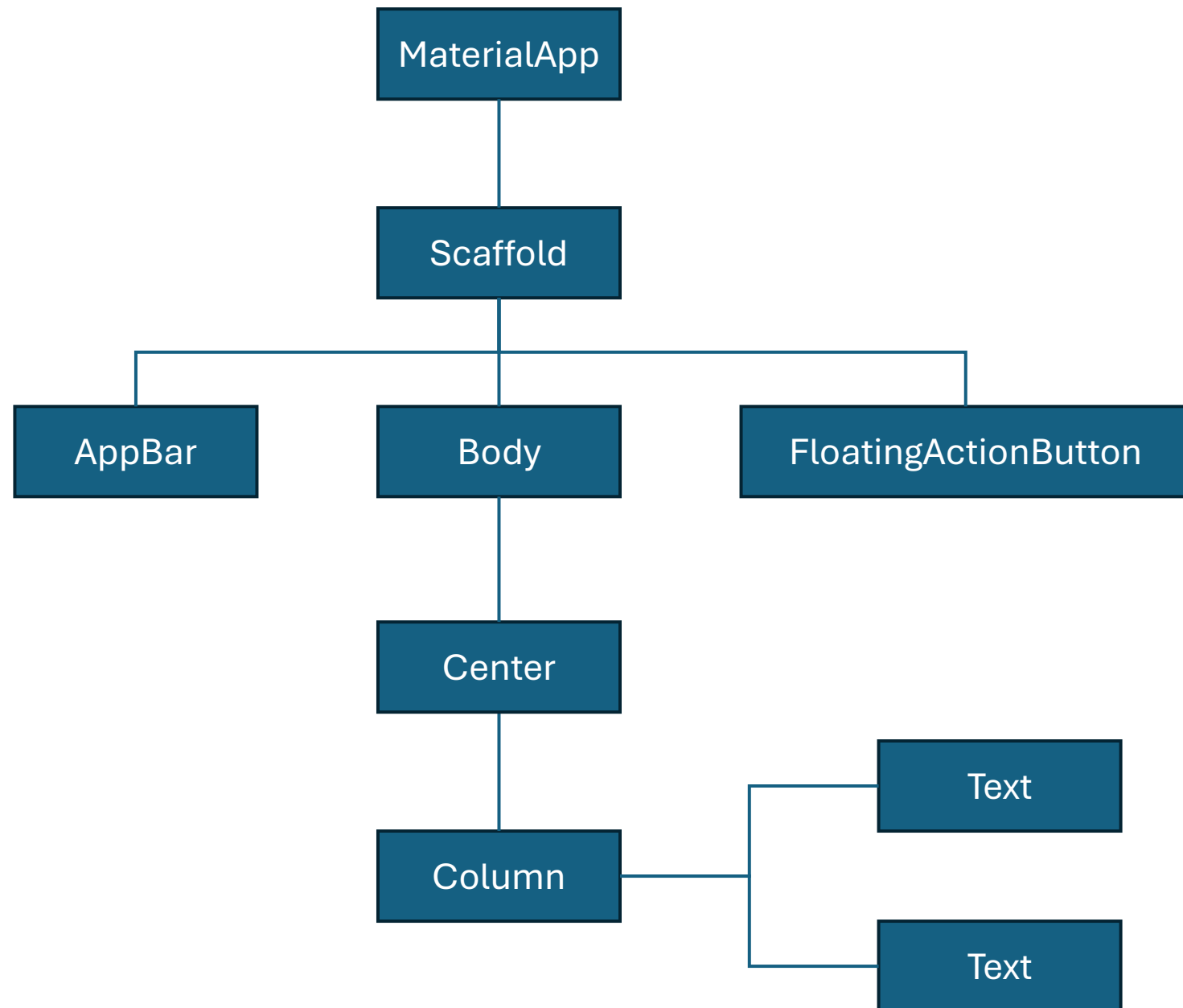
IS487 Emerging Topics in IS

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"Everything is a Widget"

- **Building blocks** of app's UI
- **Immutable** declaration of part of the UI
- Describe all aspects of a UI
 - **Physical Aspects** like text, button, ...
 - **Layout Aspects** like arrangement, padding, alignment,...
- A hierarchy based on composition

Composition Hierarchy



Scaffold Class

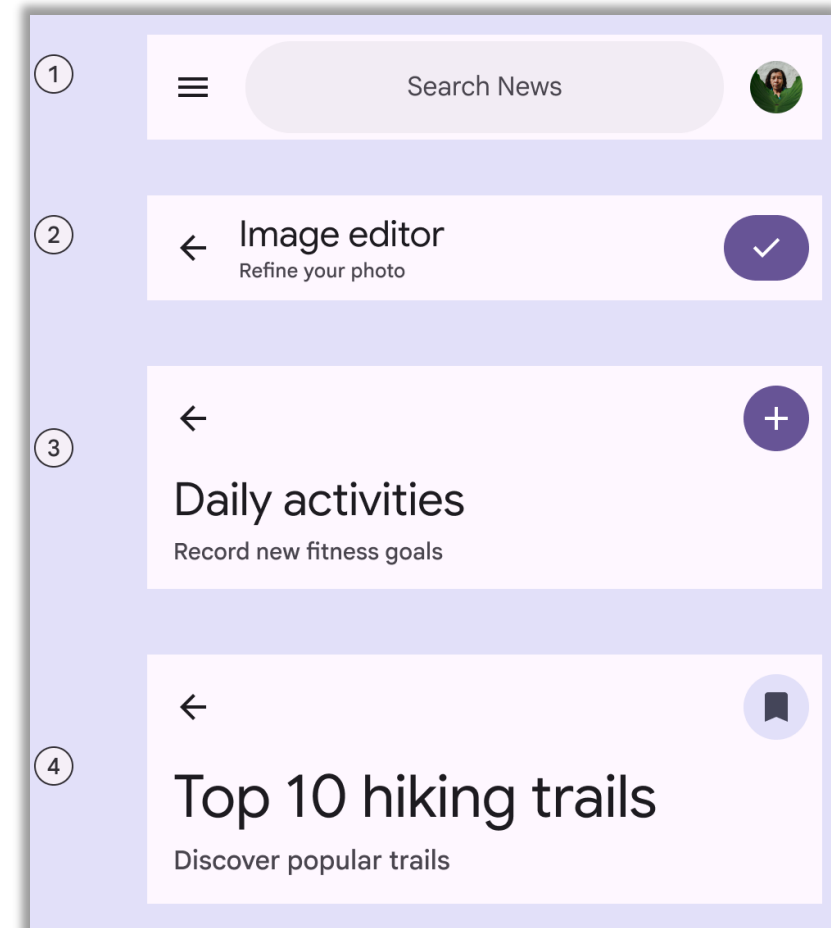
- Material Design visual **layout structure**
- AppBar
- Body - main components of App's UI
- BottomNavigationBar
- BottomSheet
- Drawer
- EndDrawer
- FloatingActionButton

Scaffold - App Bar

- Focus on describing the current page and provide 1-2 essential actions
- Displays labels and page navigation controls
- Four types: Search app bar, small, medium flexible, large flexible

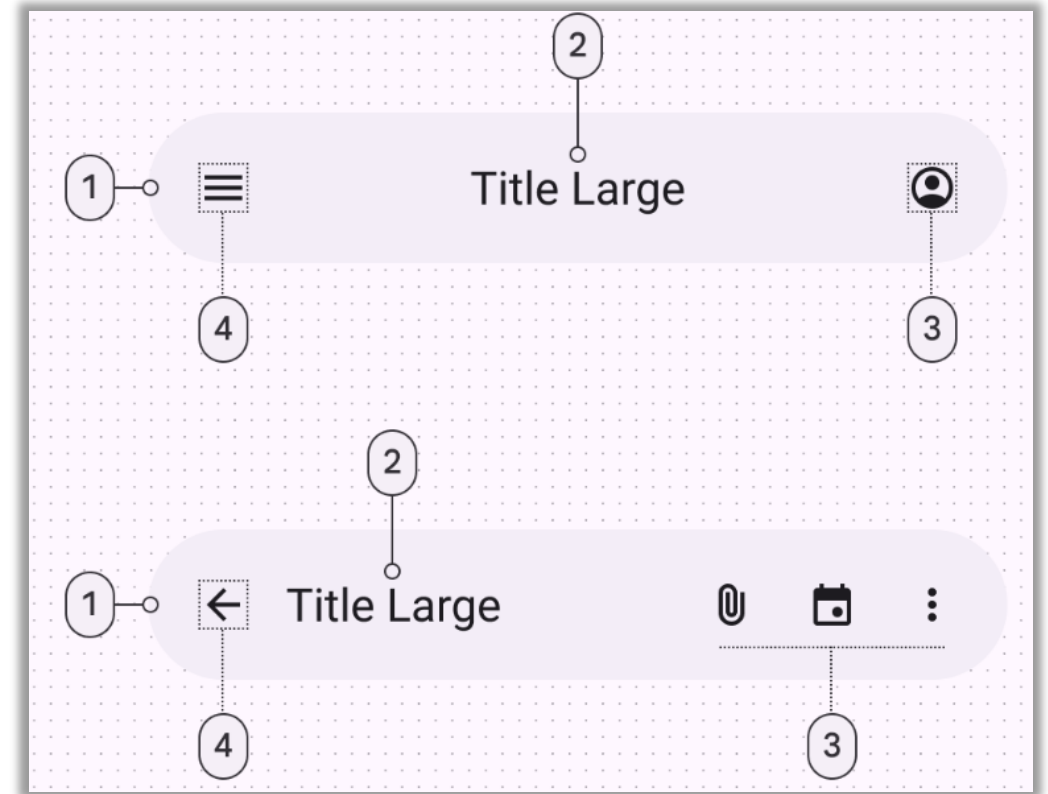
Scaffold - App Bar

1. Search app bar
2. Small
3. Medium flexible
4. Large flexible



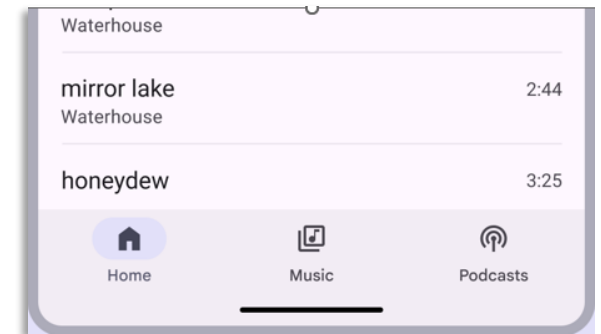
Scaffold - App Bar

1. Container
2. Heading
3. Trailing Icon(s)
4. Leading Icon

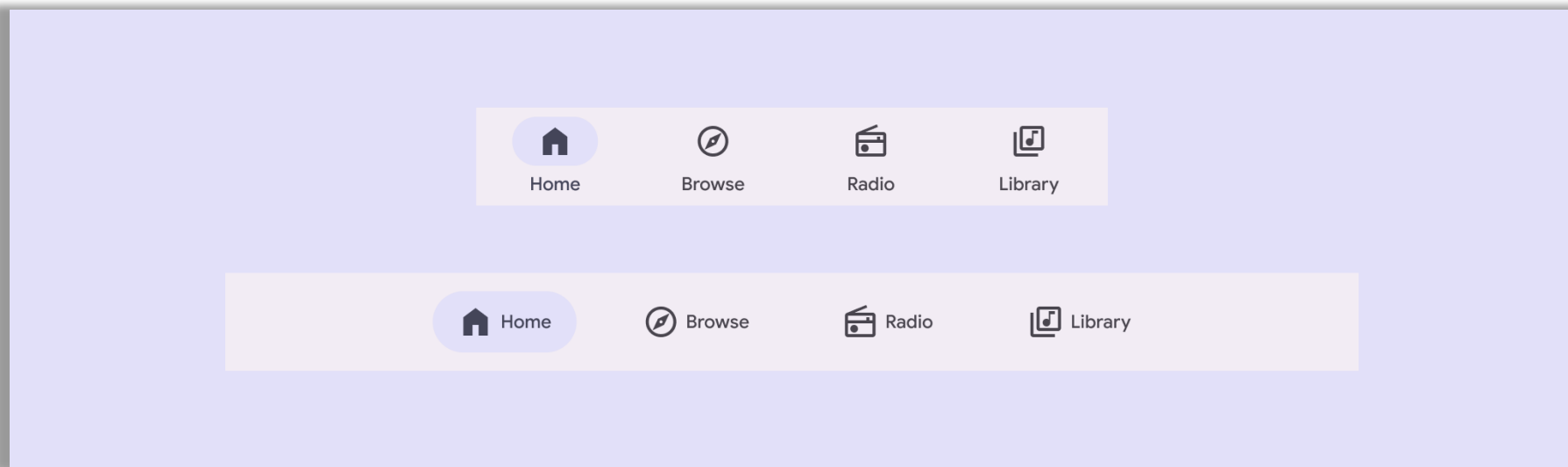


[Learn More](#)

Scaffold - Navigation Bar

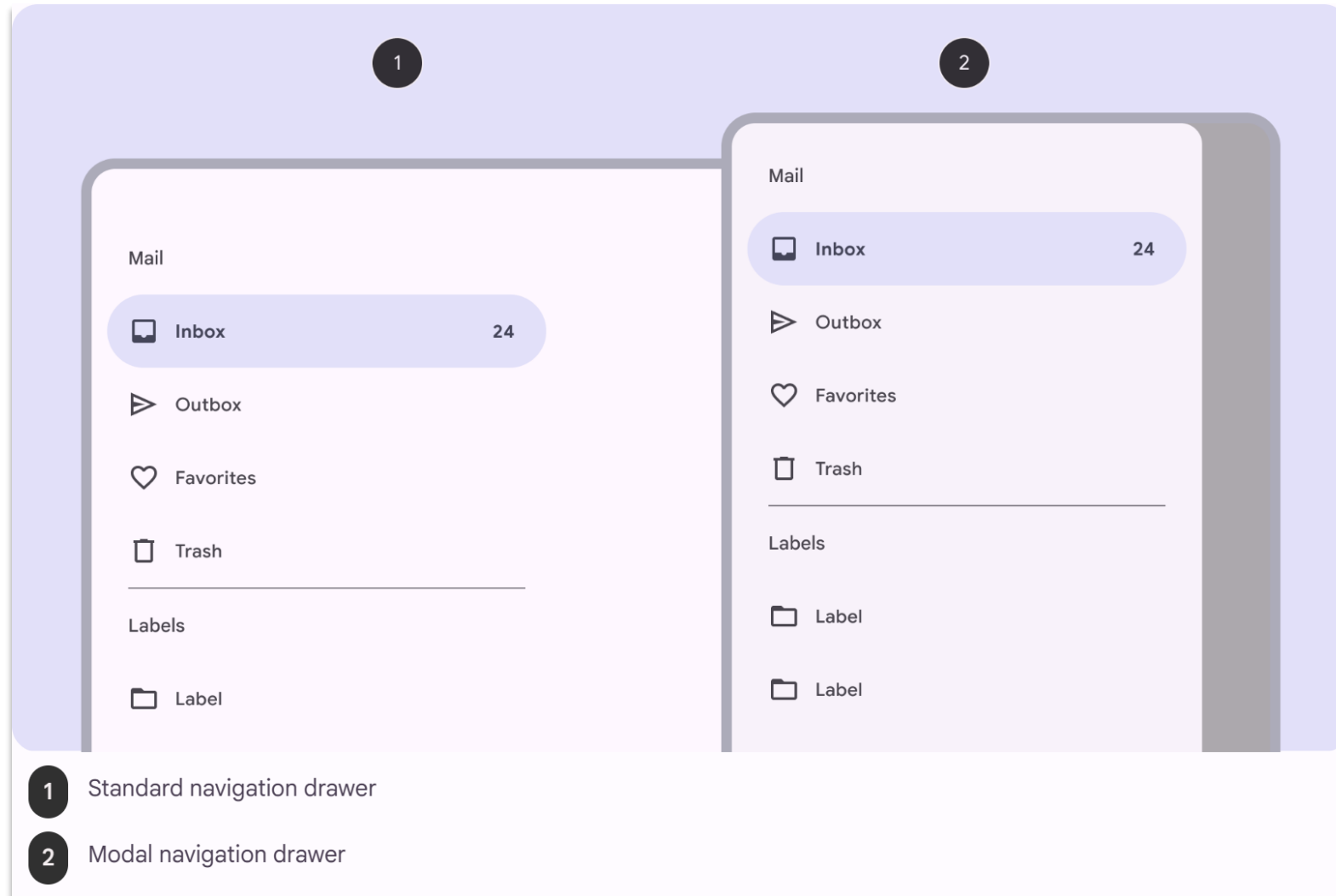


- Contain 3-5 destinations of equal importance
- Destinations don't change. They should be consistent across app screens/pages.



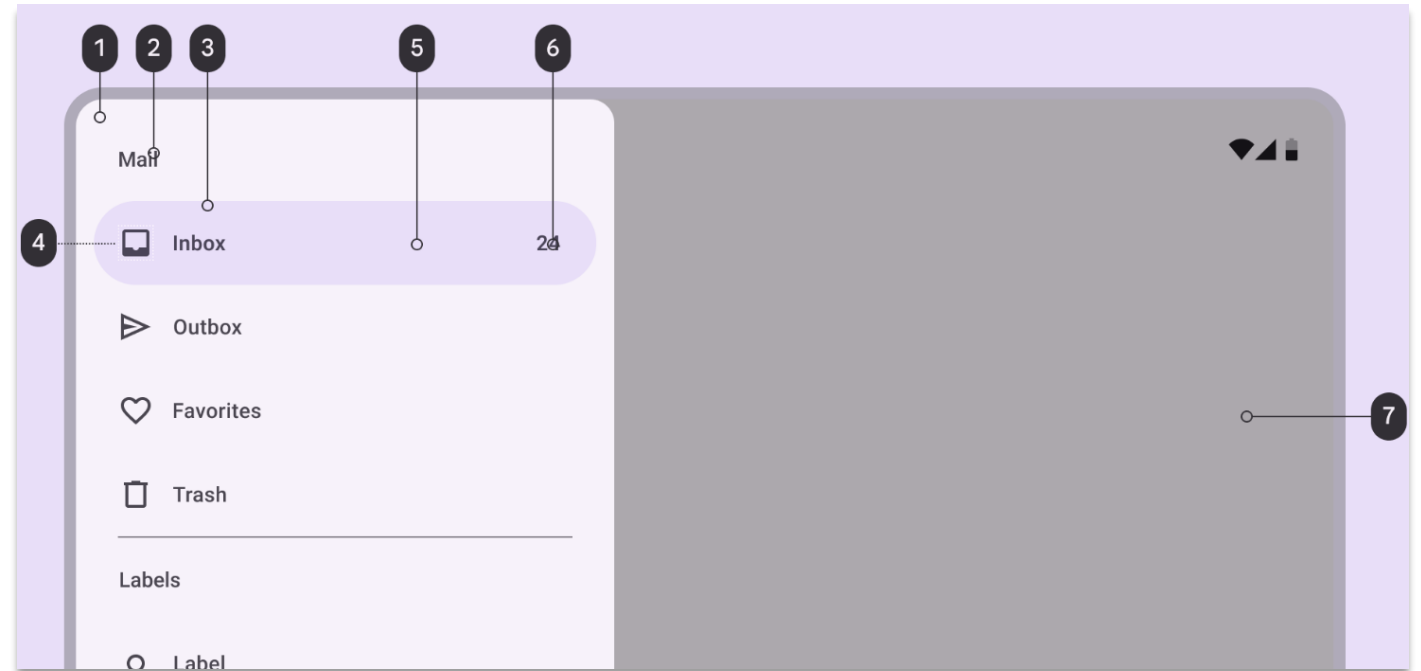
[Learn More](#)

Scaffold - Navigation Drawer



Scaffold - Navigation Drawer

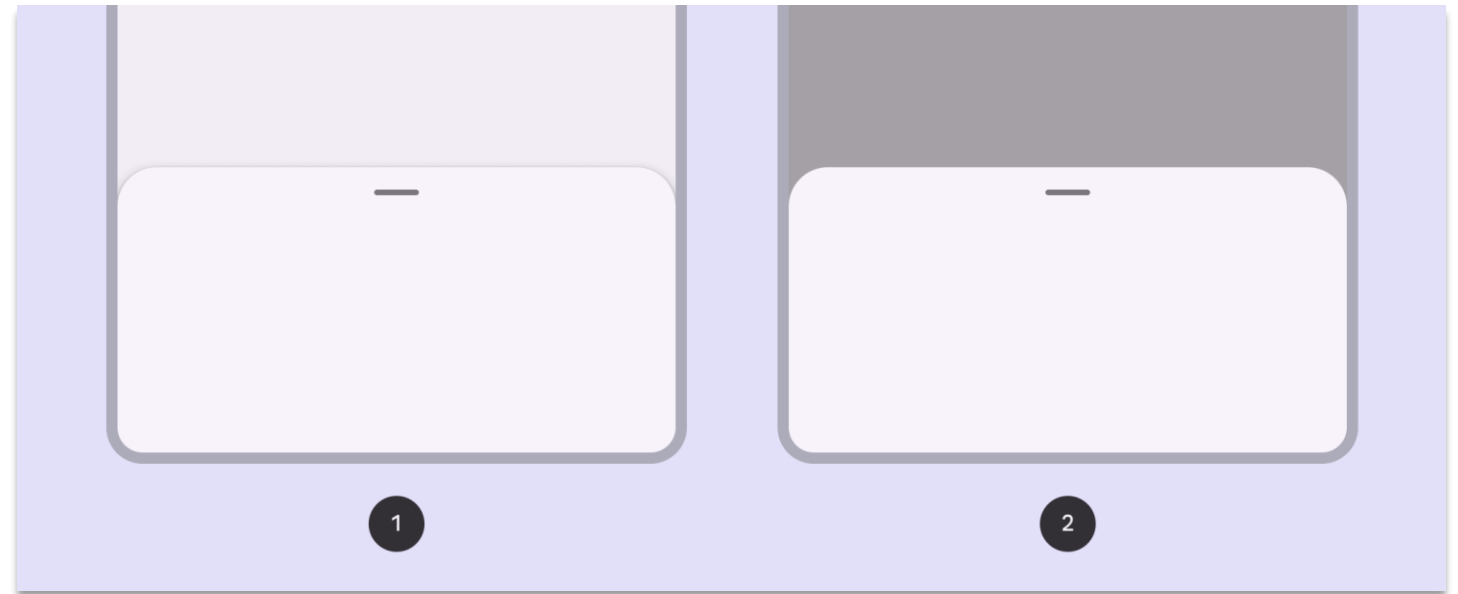
1. Container
2. Heading
3. Label Text
4. Icon
5. Active Indicator
6. Badge Label Text
7. Scrim



[Learn More](#)

Scaffold - Bottom Sheet

- Addition or secondary content
1. Standard
 2. Modal

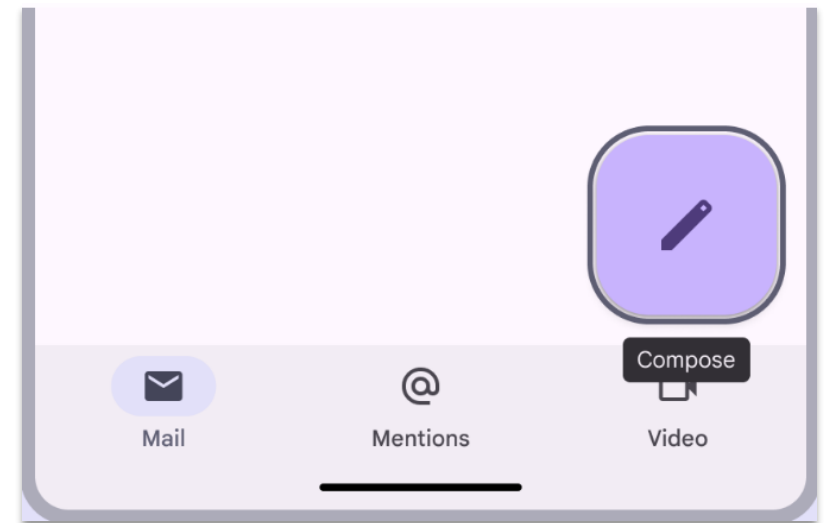


[Learn More](#)

Scaffold - FAB

People should be able to do the following using assistive technology:

- Navigate to and activate FAB
- Perform an action



[Learn More](#)

Widget Types

Stateless Widget



Stateful Widget



Stateless Widget



<https://www.youtube.com/watch?v=wE7khGHVkyY>

Stateful Widget

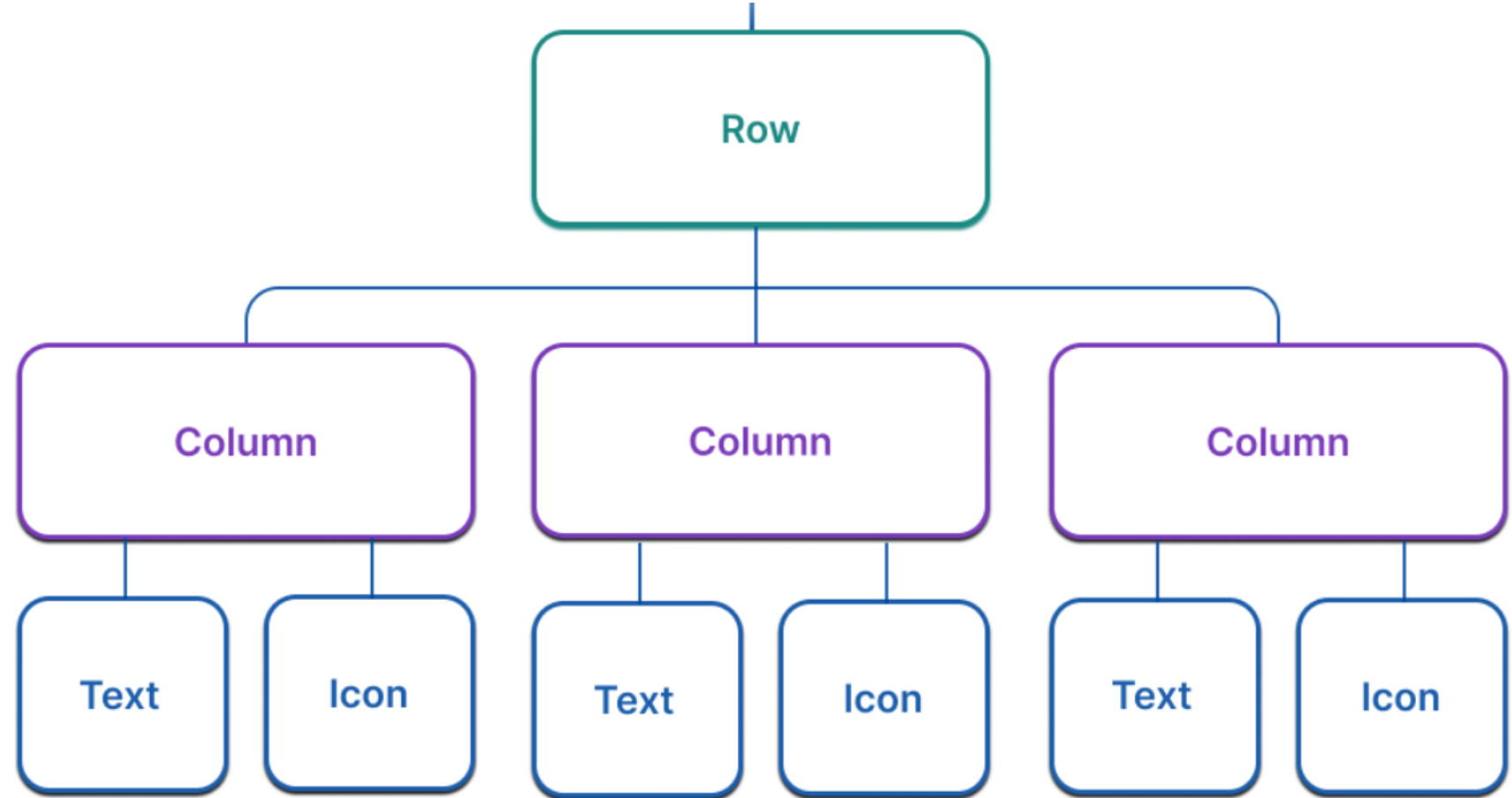
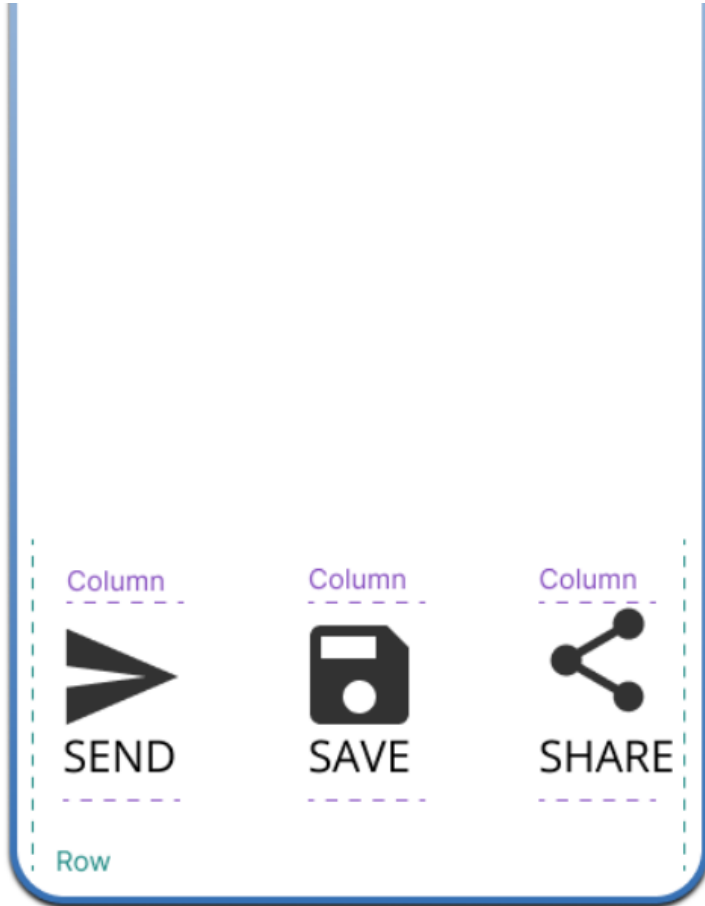


<https://www.youtube.com/watch?v=AqCMFXEmf3w>

Layout

- Size and Position
- Layout models are Widgets
- Rows, columns and grids - layout widgets that arrange, constrain and align visible Widgets
- Column - arrange elements in a vertical direction
- Row - arrange elements in a horizontal direction

Layout



Layout - Constraints

- **Size** and **Position** of any widget are constrained by its **Parent**
 - Can't have any size
 - Can't decide its own position
- Size and position determined in cooperation with Parent
- A constraint is a set of 4 doubles: **a minimum and maximum width**, and **a minimum and maximum height**.

Box Types

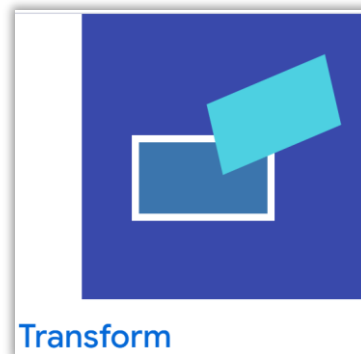
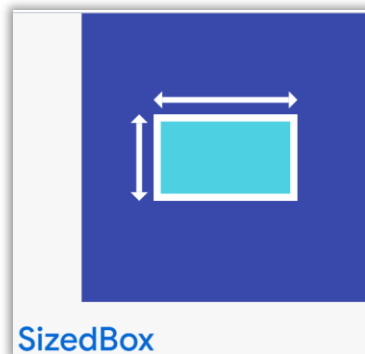
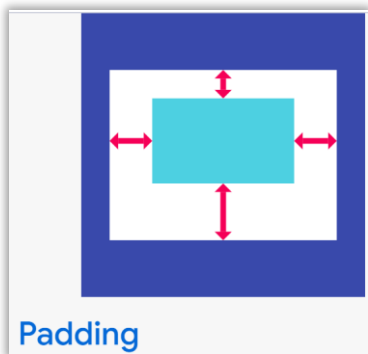
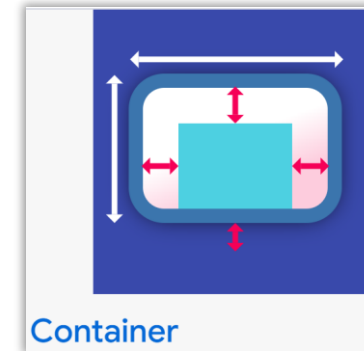
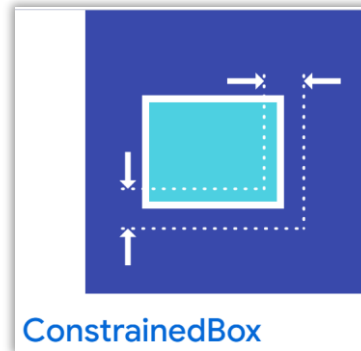
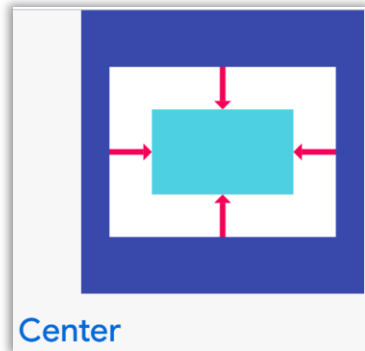
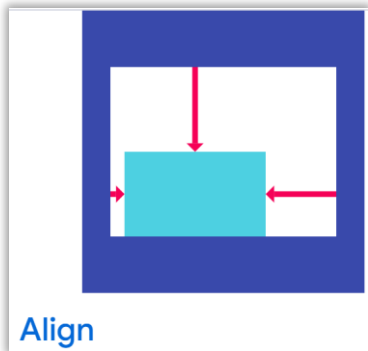
- Widgets are rendered by RenderBox
- Three Kinds
 1. Try to be as big as possible, e.g. Center, ListView
 2. Same size as child, e.g. Transform, Opacity
 3. Try to be a specific size, e.g. Image, Text

Box Types

- Container - vary from type to type based on constructor arguments - default as big as possible
- Row and Column - vary based on constraints they are given

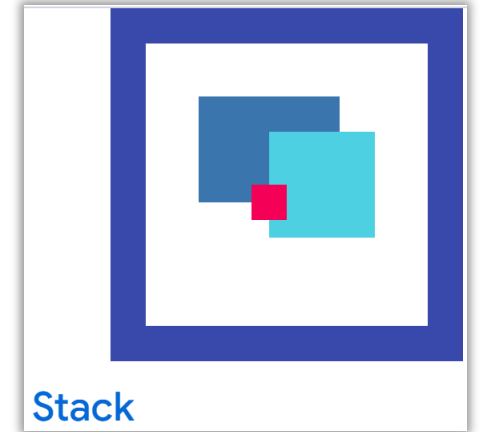
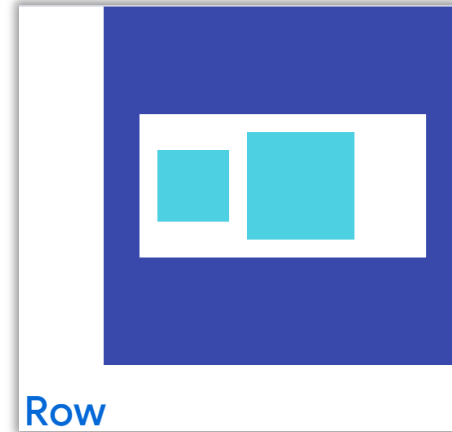
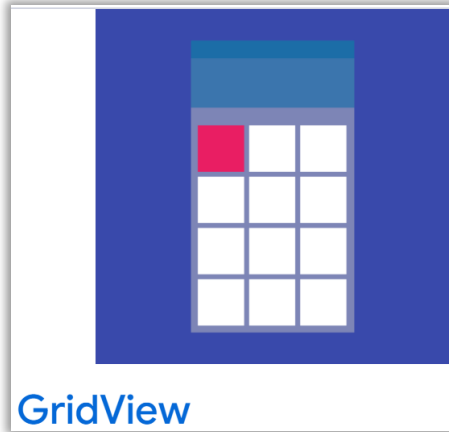
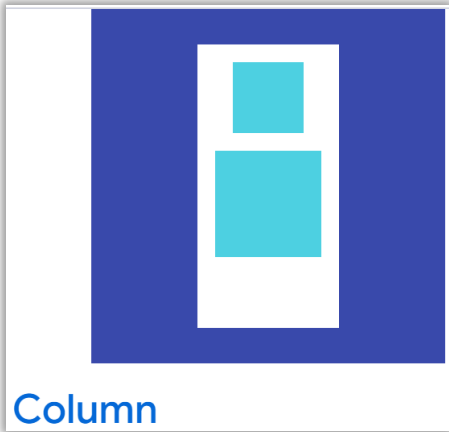
Single-Child Layout Widgets

- Apply layout to one and only child



Multi-Child Layout Widgets

- Apply layout to its children



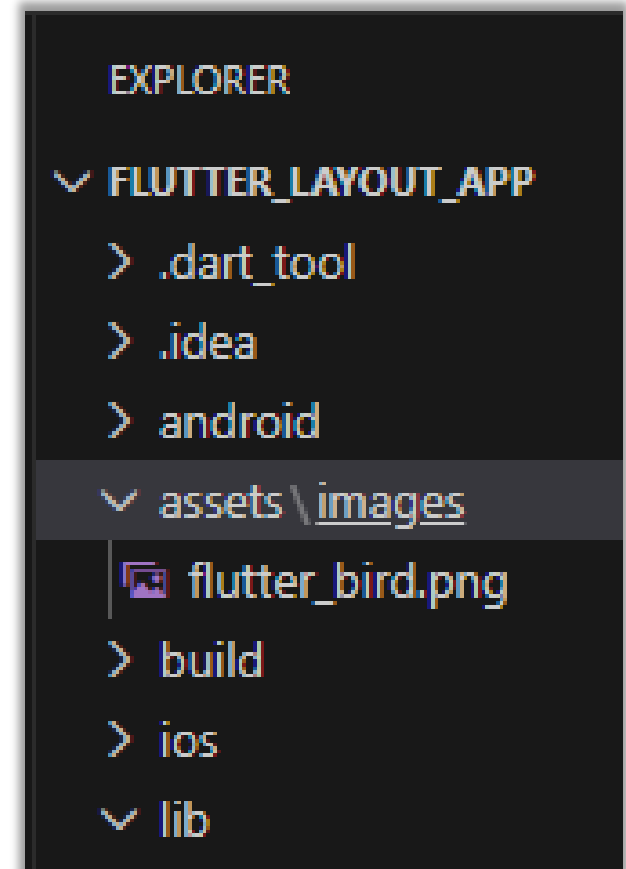
[More on Layout Widgets](#)

Create a StatelessWidget BorderedImage



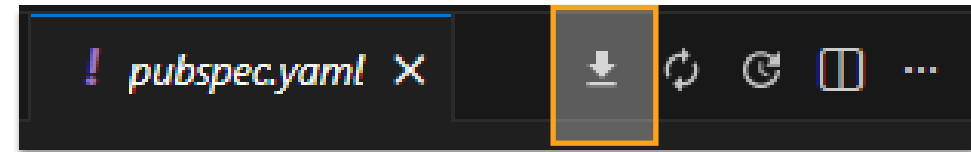
Adding Assets in Project

- Create a new folder in your project "assets"
- Create another folder in "assets" folder "images"
- Copy an image in the images folder.
Try to find a square image online.



<https://flutter.dev/brand>

Create a StatelessWidget BorderedImage



- Open the pubspec.yaml file and edit it
- Uncomment the asset section and edit as here

```
# To add assets to your application, add an assets section, like this:  
assets:  
  - assets/images/
```

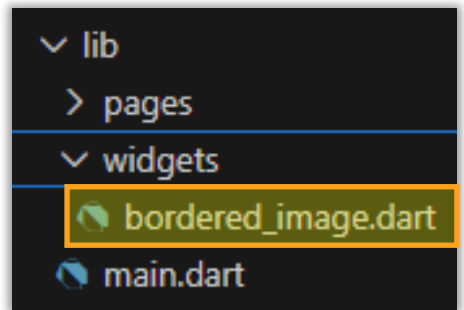
flutter pub get

```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS  
  
malik@DESKTOP-HVT445C MINGW64 /d/Teaching/IS487 Mobile Development/Code/flutter_layout_app  
$ flutter pub get  
Downloading packages...  
  characters 1.4.0 (1.4.1 available)  
  matcher 0.12.17 (0.12.18 available)  
  material_color_utilities 0.11.1 (0.13.0 available)  
  test_api 0.7.7 (0.7.8 available)  
Got dependencies!  
4 packages have newer versions incompatible with dependency constraints.  
Try `flutter pub outdated` for more information.
```

Create a Stateless Widget

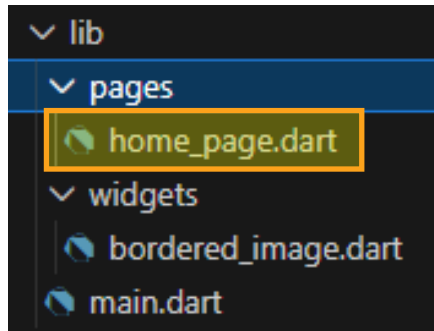
BorderedImage

```
lib > widgets > bordered_image.dart > ...
1  import 'package:flutter/material.dart';
2
3  class BorderedImage extends StatelessWidget {
4    final double borderWidth;
5    final Color borderColor;
6    final double borderRadius;
7    final double imageSize;
8
9    const BorderedImage({
10      super.key,
11      this.borderWidth = 2.0,
12      this.borderColor = Colors.blueGrey,
13      this.borderRadius = 20,
14      this.imageSize = 100.0,
15    });
16
17    @override
18    Widget build(BuildContext context) {
19      return Container(
20        width: imageSize + (borderWidth * 2),
21        height: imageSize + (borderWidth * 2),
22        decoration: BoxDecoration(
23          border: Border.all(color: borderColor, width: borderWidth),
24          borderRadius: BorderRadius.circular(borderRadius),
25        ), // BoxDecoration
26        child: Image.asset(
27          'assets/images/flutter_bird.png',
28          width: imageSize,
29          height: imageSize,
30        ), // Image.asset
31      ); // Container
32    }
33  }
```



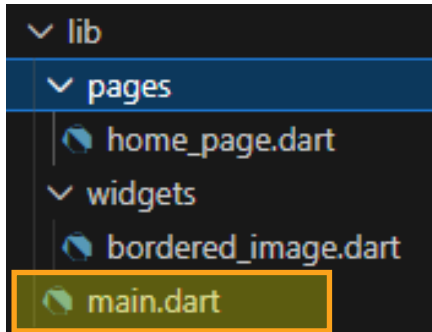
Container

HomePage

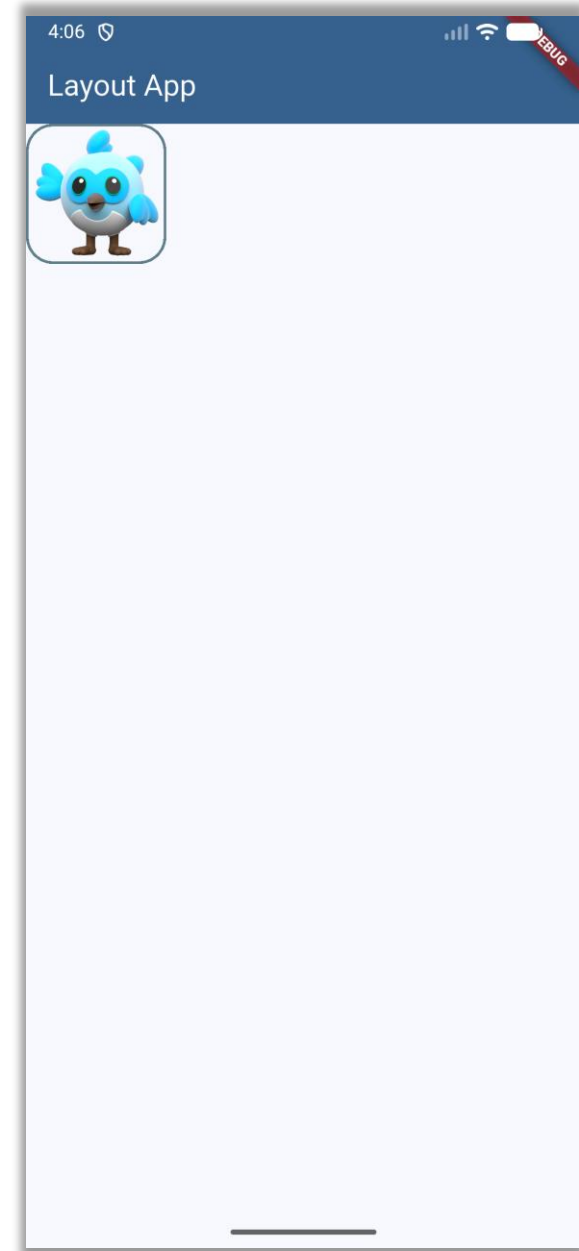


```
home_page.dart X
lib > pages > home_page.dart > ...
1  import 'package:flutter/material.dart';
2  import 'package:flutter_layout_app/widgets/bordered_image.dart';
3
4  class HomePage extends StatelessWidget {
5    const HomePage({super.key});
6
7    @override
8    Widget build(BuildContext context) {
9      return Scaffold(
10        appBar: AppBar(
11          backgroundColor: Theme.of(context).colorScheme.primary,
12          title: Text('Layout App', style: TextStyle(color: Colors.white)),
13        ), // AppBar
14        body: BorderedImage(),
15      ); // Scaffold
16    }
17  }
18
19
20
```

main.dart

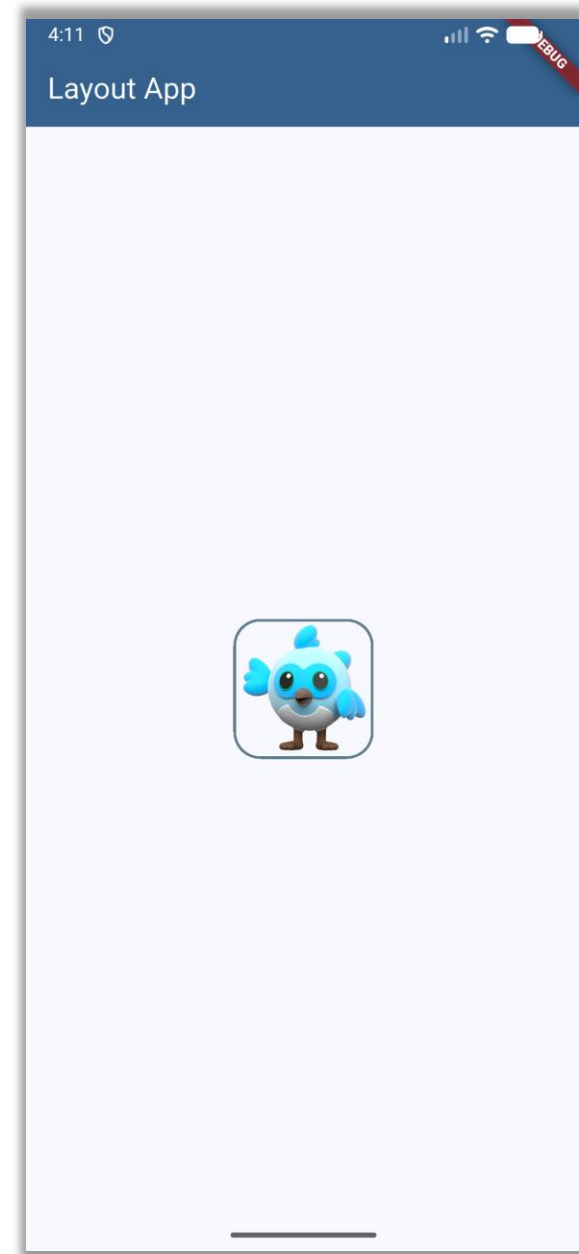


```
main.dart X home_page.dart
lib > main.dart > ...
1  import 'package:flutter/material.dart';
2  import 'package:flutter_layout_app/pages/home_page.dart';
3
4  Run | Debug | Profile
5  void main() {
6    runApp(const MyApp());
7  }
8
9  class MyApp extends StatelessWidget {
10    const MyApp({super.key});
11
12    // This widget is the root of your application.
13    @override
14    Widget build(BuildContext context) {
15      return MaterialApp(
16        title: 'Flutter Demo',
17        theme: ThemeData(
18          colorScheme: .fromSeed(seedColor: Colors.blue),
19        ), // ThemeData
20        home: const HomePage(),
21      ); // MaterialApp
22    }
23  }
```



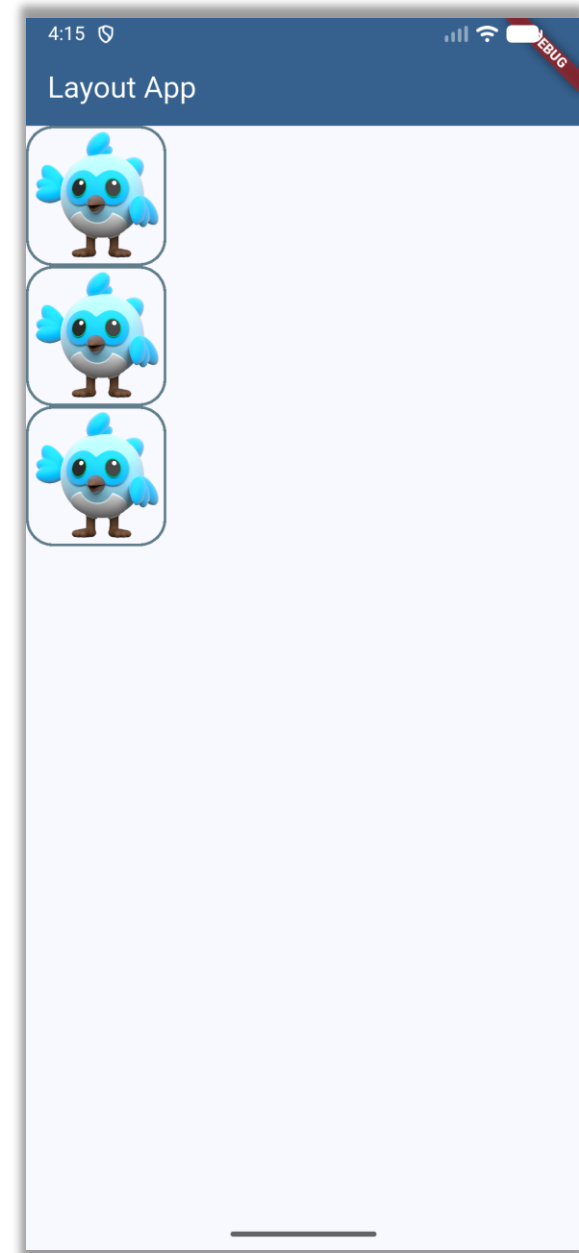
Center Widget

```
main.dart  home_page.dart X
lib > pages > home_page.dart > ...
1  import 'package:flutter/material.dart';
2  import 'package:flutter_layout_app/widgets/bordered_image.dart';
3
4  class HomePage extends StatelessWidget {
5    const HomePage({super.key});
6
7    @override
8    Widget build(BuildContext context) {
9      return Scaffold(
10        appBar: AppBar(
11          backgroundColor: Theme.of(context).colorScheme.primary,
12          title: Text('Layout App', style: TextStyle(color: Colors.white)),
13        ), // AppBar
14        body: Center(
15          child: BorderedImage(),
16        ), // Center
17      ); // Scaffold
18    }
19  }
```



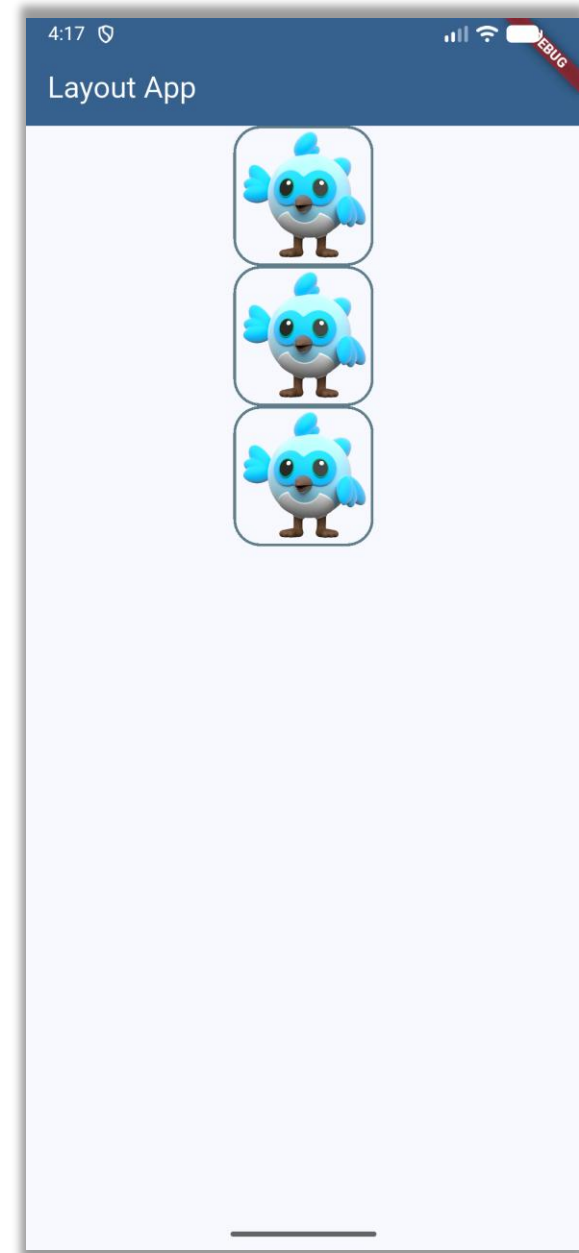
Column Widget

```
main.dart  home_page.dart X
lib > pages > home_page.dart > ...
1  import 'package:flutter/material.dart';
2  import 'package:flutter_layout_app/widgets/bordered_image.dart';
3
4  class HomePage extends StatelessWidget {
5    const HomePage({super.key});
6
7    @override
8    Widget build(BuildContext context) {
9      return Scaffold(
10        appBar: AppBar(
11          backgroundColor: Theme.of(context).colorScheme.primary,
12          title: Text('Layout App', style: TextStyle(color: Colors.white)),
13        ), // AppBar
14        body: Column(
15          children: [BorderedImage(), BorderedImage(), BorderedImage()],
16        ), // Column
17      ); // Scaffold
18    }
19  }
```



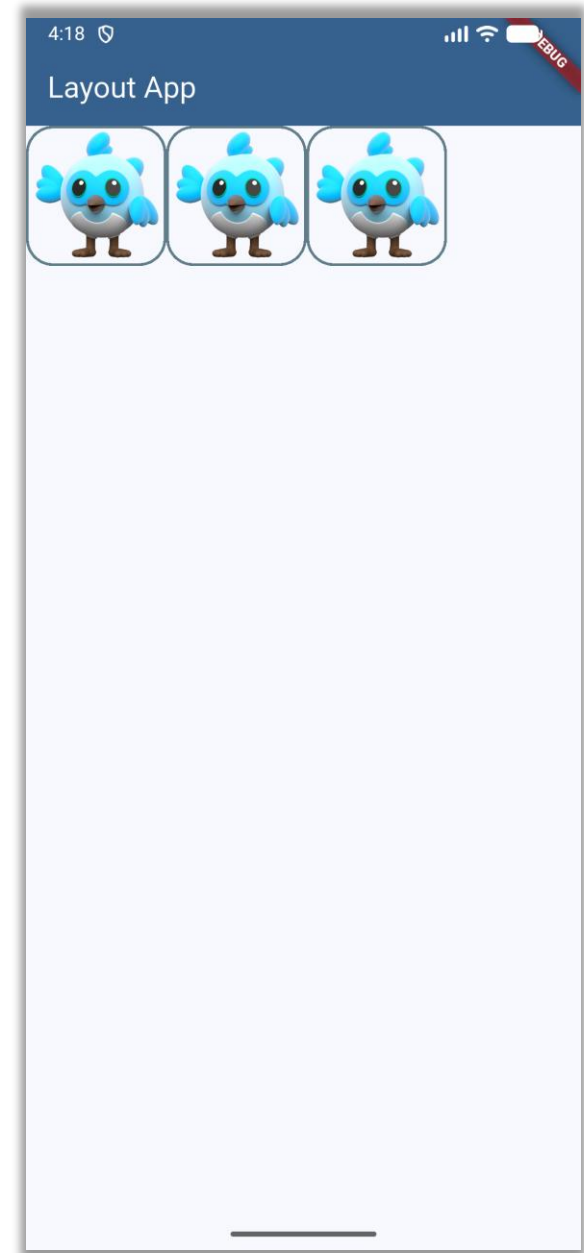
Center -> Column Widget

```
main.dart  home_page.dart X
lib > pages > home_page.dart > ...
1  import 'package:flutter/material.dart';
2  import 'package:flutter_layout_app/widgets/bordered_image.dart';
3
4  class HomePage extends StatelessWidget {
5    const HomePage({super.key});
6
7    @override
8    Widget build(BuildContext context) {
9      return Scaffold(
10        appBar: AppBar(
11          backgroundColor: Theme.of(context).colorScheme.primary,
12          title: Text('Layout App', style: TextStyle(color: Colors.white)),
13        ), // AppBar
14        body: Center(
15          child: Column(
16            children: [BorderedImage(), BorderedImage(), BorderedImage()],
17          ), // Column
18        ), // Center
19      ); // Scaffold
20    }
21  }
```



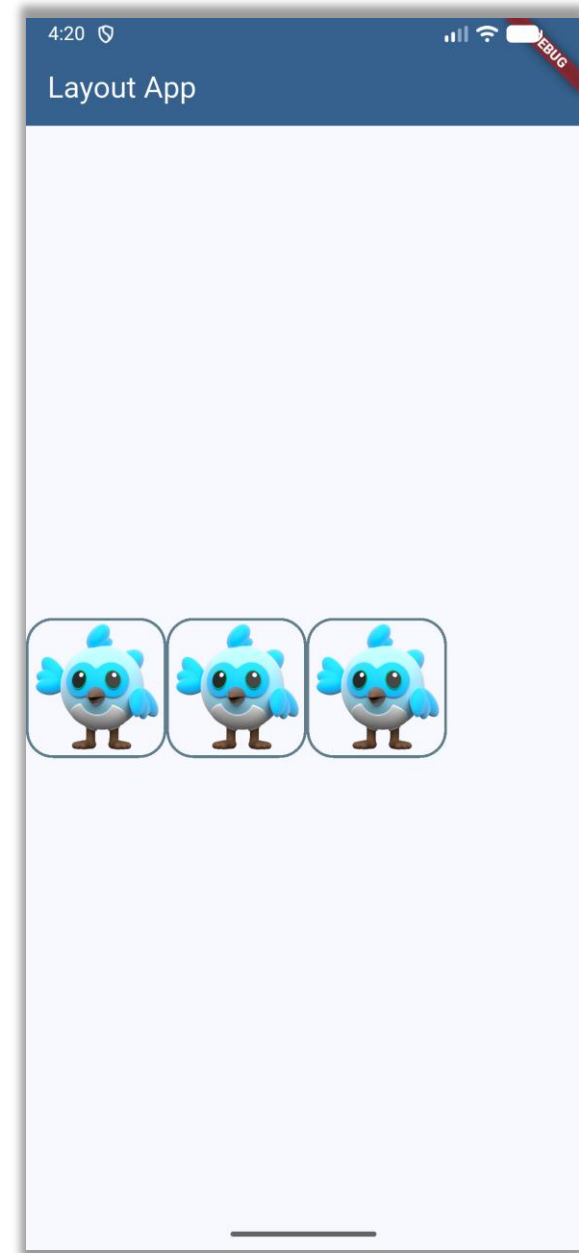
Row Widget

```
main.dart  home_page.dart X
lib > pages > home_page.dart > ...
1  import 'package:flutter/material.dart';
2  import 'package:flutter_layout_app/widgets/bordered_image.dart';
3
4  class HomePage extends StatelessWidget {
5    const HomePage({super.key});
6
7    @override
8    Widget build(BuildContext context) {
9      return Scaffold(
10        appBar: AppBar(
11          backgroundColor: Theme.of(context).colorScheme.primary,
12          title: Text('Layout App', style: TextStyle(color: Colors.white)),
13        ), // AppBar
14        body: Row(
15          children: [BorderedImage(), BorderedImage(), BorderedImage()],
16        ), // Row
17      ); // Scaffold
18    }
19  }
```



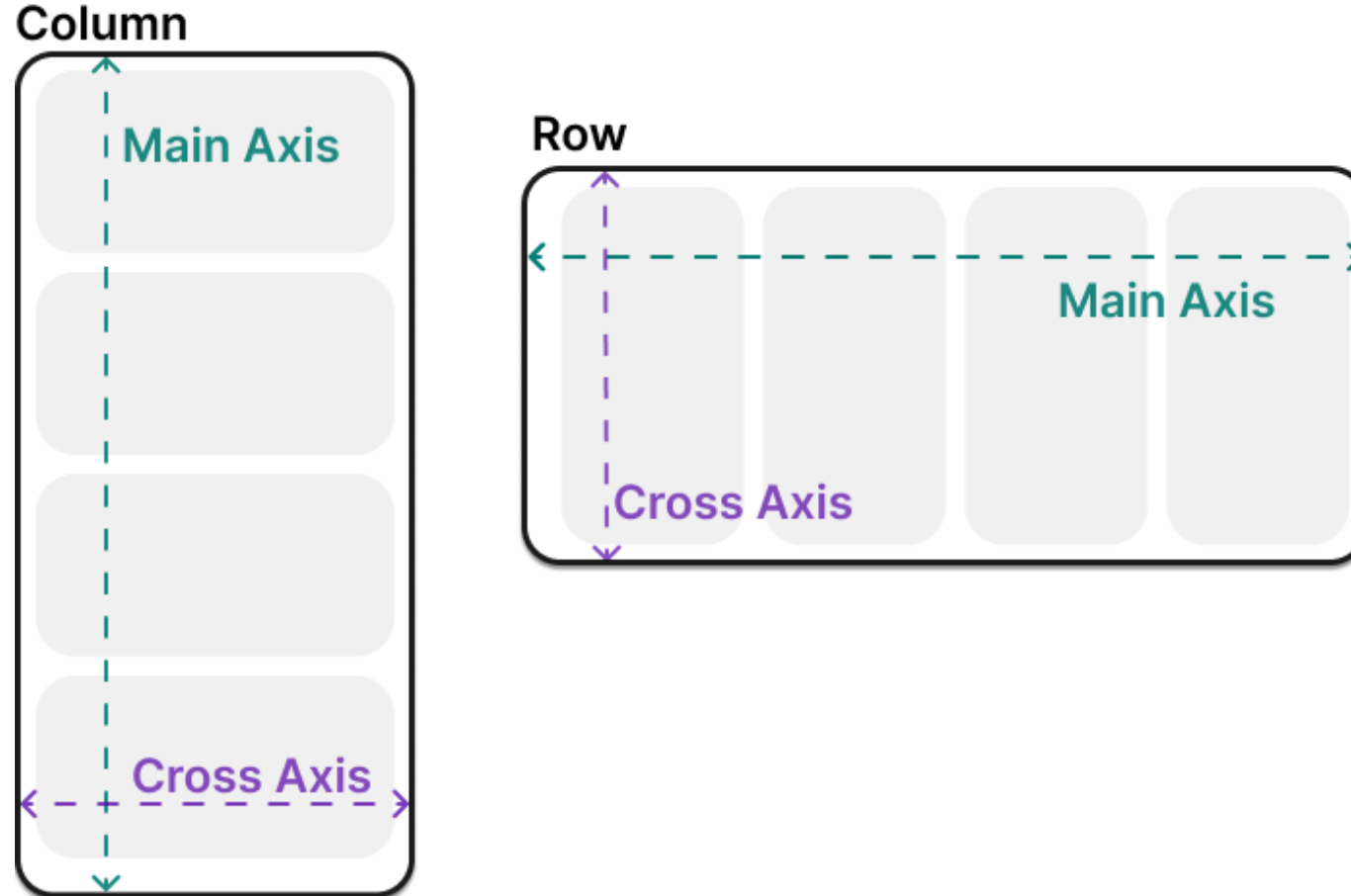
Center -> Row Widget

```
main.dart  home_page.dart X
lib > pages > home_page.dart > ...
1  import 'package:flutter/material.dart';
2  import 'package:flutter_layout_app/widgets/bordered_image.dart';
3
4  class HomePage extends StatelessWidget {
5    const HomePage({super.key});
6
7    @override
8    Widget build(BuildContext context) {
9      return Scaffold(
10        appBar: AppBar(
11          backgroundColor: Theme.of(context).colorScheme.primary,
12          title: Text('Layout App', style: TextStyle(color: Colors.white)),
13        ), // AppBar
14        body: Center(
15          child: Row(
16            children: [BorderedImage(), BorderedImage(), BorderedImage()],
17          ), // Row
18        ), // Center
19      ); // Scaffold
20    }
21  }
```



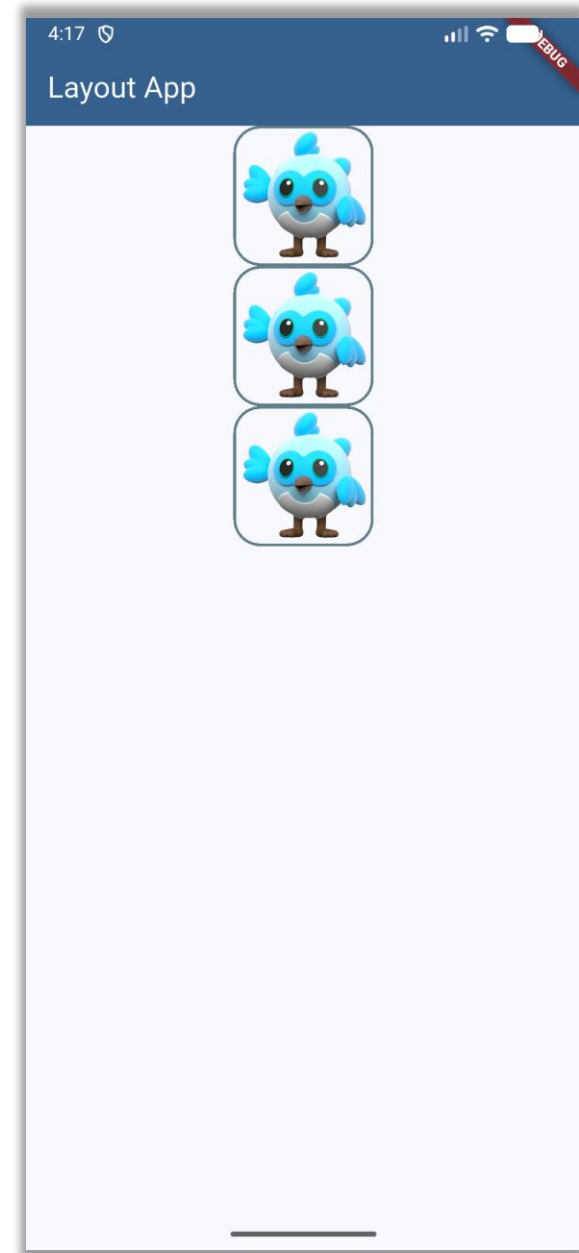
Align Widgets within Rows and Columns

Main Axis and Cross Axis



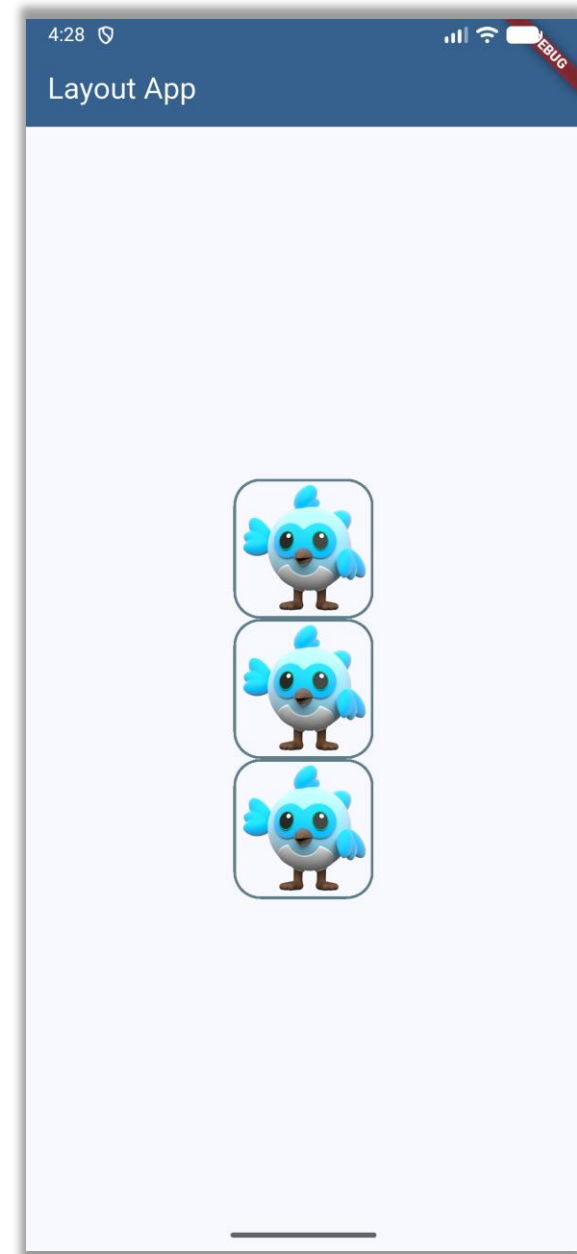
Center -> Column Widget

```
main.dart  home_page.dart X
lib > pages > home_page.dart > ...
1  import 'package:flutter/material.dart';
2  import 'package:flutter_layout_app/widgets/bordered_image.dart';
3
4  class HomePage extends StatelessWidget {
5    const HomePage({super.key});
6
7    @override
8    Widget build(BuildContext context) {
9      return Scaffold(
10        appBar: AppBar(
11          backgroundColor: Theme.of(context).colorScheme.primary,
12          title: Text('Layout App', style: TextStyle(color: Colors.white)),
13        ), // AppBar
14        body: Center(
15          child: Column(
16            children: [BorderedImage(), BorderedImage(), BorderedImage()],
17          ), // Column
18        ), // Center
19      ); // Scaffold
20    }
21  }
```



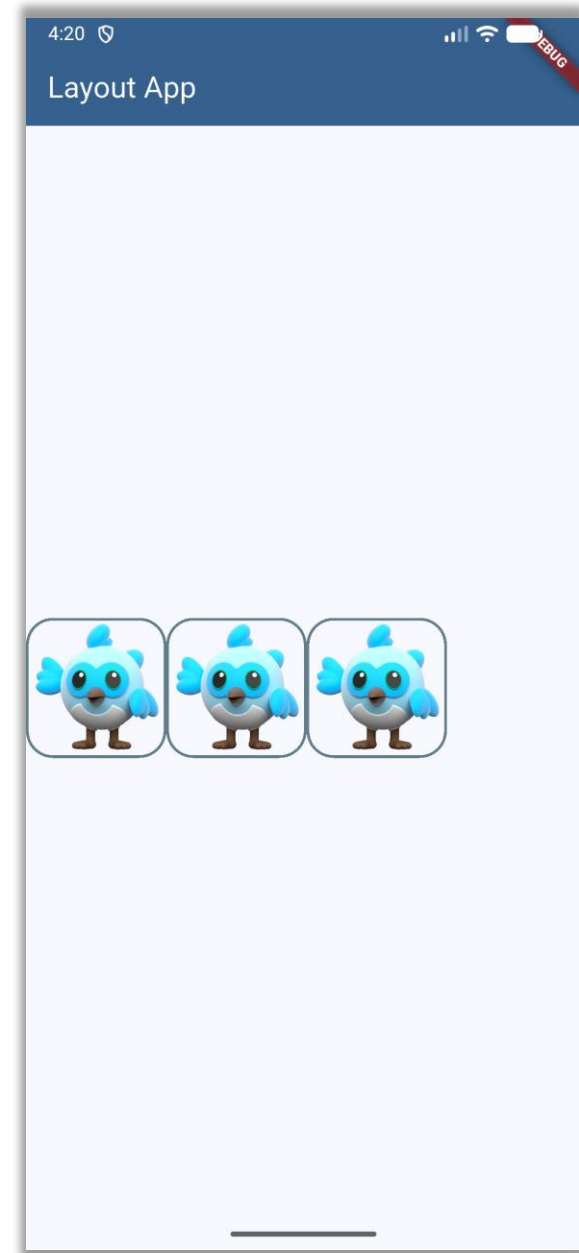
Center -> Column Widget mainAxisAlignment

```
main.dart  home_page.dart X
lib > pages > home_page.dart > ...
1  import 'package:flutter/material.dart';
2  import 'package:flutter_layout_app/widgets/bordered_image.dart';
3
4  class HomePage extends StatelessWidget {
5    const HomePage({super.key});
6
7    @override
8    Widget build(BuildContext context) {
9      return Scaffold(
10        appBar: AppBar(
11          backgroundColor: Theme.of(context).colorScheme.primary,
12          title: Text('Layout App', style: TextStyle(color: Colors.white)),
13        ), // AppBar
14        body: Center(
15          child: Column(
16            mainAxisAlignment: MainAxisAlignment.center,
17            children: [BorderedImage(), BorderedImage(), BorderedImage()],
18          ), // Column
19        ), // Center
20      ); // Scaffold
21    }
22  }
```



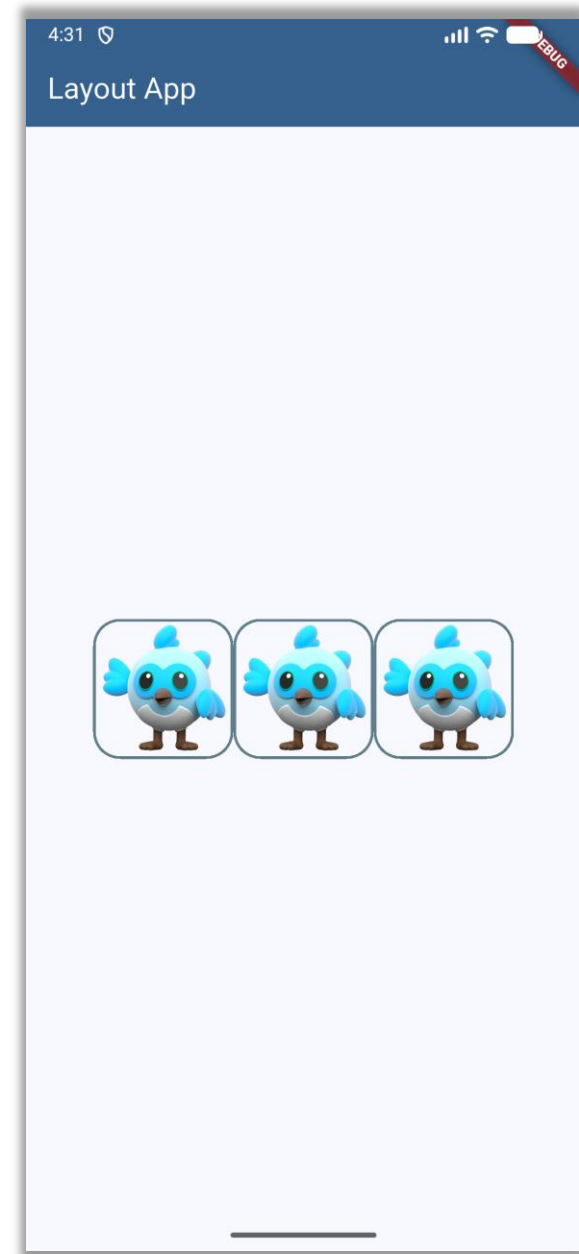
Center -> Row Widget

```
main.dart  home_page.dart X
lib > pages > home_page.dart > ...
1  import 'package:flutter/material.dart';
2  import 'package:flutter_layout_app/widgets/bordered_image.dart';
3
4  class HomePage extends StatelessWidget {
5    const HomePage({super.key});
6
7    @override
8    Widget build(BuildContext context) {
9      return Scaffold(
10        appBar: AppBar(
11          backgroundColor: Theme.of(context).colorScheme.primary,
12          title: Text('Layout App', style: TextStyle(color: Colors.white)),
13        ), // AppBar
14        body: Center(
15          child: Row(
16            children: [BorderedImage(), BorderedImage(), BorderedImage()],
17          ), // Row
18        ), // Center
19      ); // Scaffold
20    }
21  }
```



Center -> Row Widget mainAxisAlignment

```
main.dart  home_page.dart X
lib > pages > home_page.dart > ...
1  import 'package:flutter/material.dart';
2  import 'package:flutter_layout_app/widgets/bordered_image.dart';
3
4  class HomePage extends StatelessWidget {
5    const HomePage({super.key});
6
7    @override
8    Widget build(BuildContext context) {
9      return Scaffold(
10        appBar: AppBar(
11          backgroundColor: Theme.of(context).colorScheme.primary,
12          title: Text('Layout App', style: TextStyle(color: Colors.white)),
13        ), // AppBar
14        body: Center(
15          child: Row(
16            mainAxisAlignment: MainAxisAlignment.center,
17            children: [BorderedImage(), BorderedImage(), BorderedImage()],
18          ), // Row
19        ), // Center
20      ); // Scaffold
21    }
22  }
```



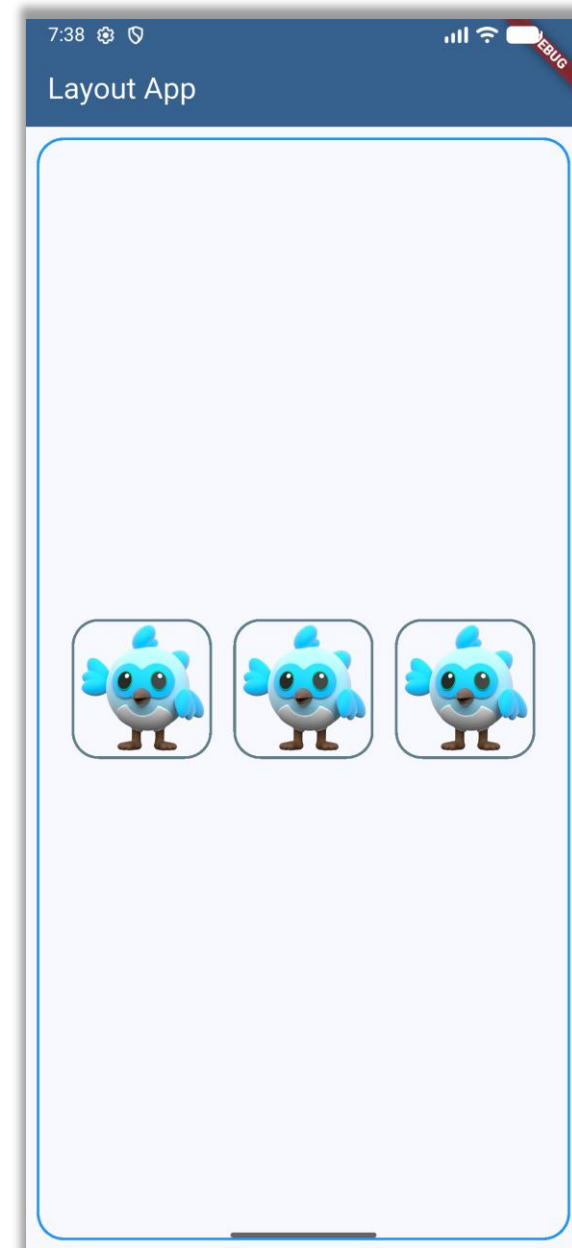
Other Options

```
body: Center(  
  child: Row(  
    mainAxisAlignment: MainAxisAlignment.  
    children: [BorderedImage(), BorderedI  
  ], // Row  
, // Center  
; // Scaffold
```

- center MainAxisAlignment
- end MainAxisAlignment
- spaceAround MainAxisAlignment
- spaceBetween MainAxisAlignment
- spaceEvenly MainAxisAlignment
- start MainAxisAlignment
- values List<MainAxisAlignment>

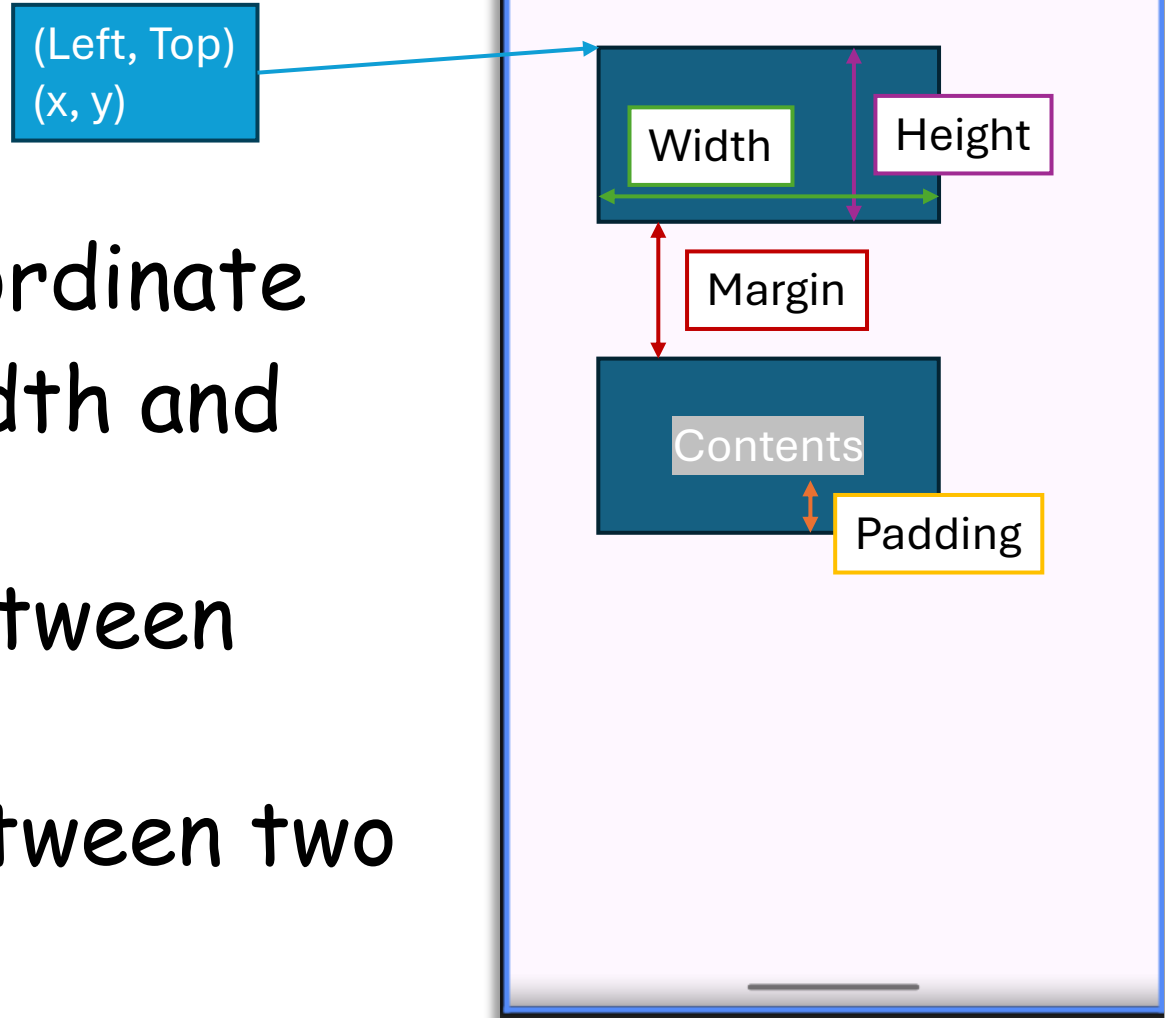
```
main.dart  home_page.dart X  bordered_image.dart  00

lib > pages > home_page.dart > HomePage > build
1  import 'package:flutter/material.dart';
2  import 'package:flutter_layout_app/widgets/bordered_image.dart';
3
4  class HomePage extends StatelessWidget {
5    const HomePage({super.key});
6
7    @override
8    Widget build(BuildContext context) {
9      return Scaffold(
10        appBar: AppBar(
11          backgroundColor: Theme.of(context).colorScheme.primary,
12          title: Text('Layout App', style: TextStyle(color: Colors.white)),
13        ), // AppBar
14        body: Container(
15          margin: EdgeInsets.all(8.0),
16          padding: EdgeInsets.all(8.0),
17          height: MediaQuery.of(context).size.height,
18          decoration: BoxDecoration(
19            border: Border.all(color: Colors.blue, width: 2),
20            borderRadius: BorderRadius.circular(20.0),
21          ), // BoxDecoration
22          child: Row(
23            mainAxisAlignment: MainAxisAlignment.spaceEvenly,
24            crossAxisAlignment: CrossAxisAlignment.center,
25            children: [BorderedImage(), BorderedImage(), BorderedImage()],
26          ), // Row
27        ), // Container
28      ); // Scaffold
29    }
30  }
```



Box Model

- A rectangle box
- **Position**: left and top coordinate
- **Size**: two dimensions, width and height
- **Padding**: Empty space between contents and Border
- **Margin**: Empty Space between two widgets



Screen Overflow

```
child: Row(  
  mainAxisAlignment: MainAxisAlignment.spaceEvenly,  
  crossAxisAlignment: CrossAxisAlignment.center,  
  children: [  
    BorderedImage(),  
    BorderedImage(),  
    BorderedImage(),  
    BorderedImage(),  
  ],  
) , // Row
```

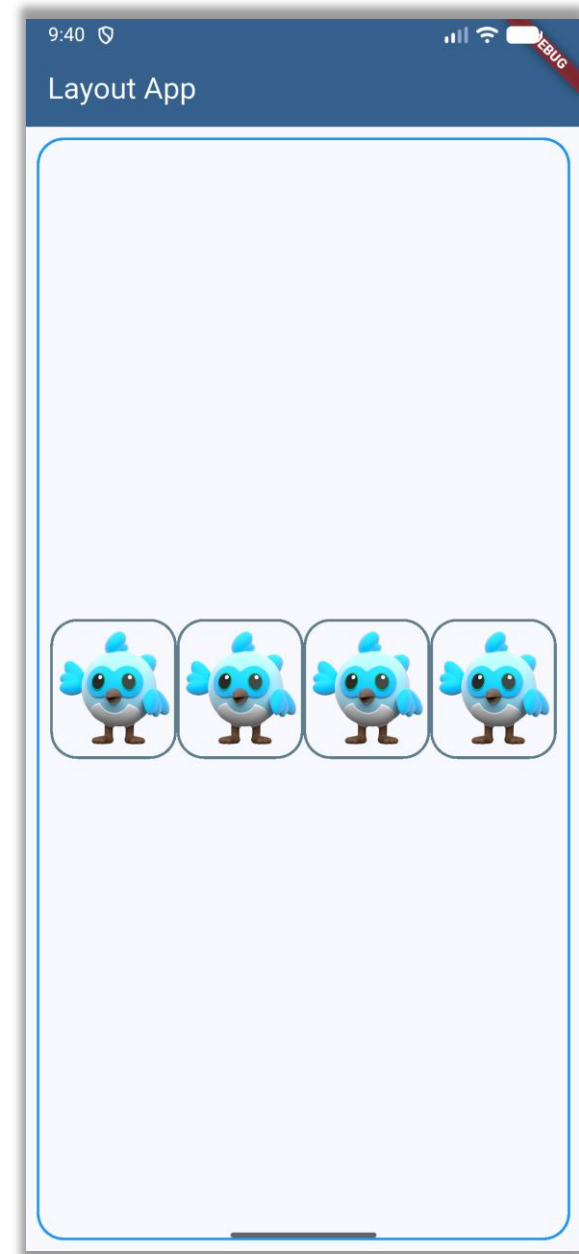
Two ways to handle this



Expanded Widget

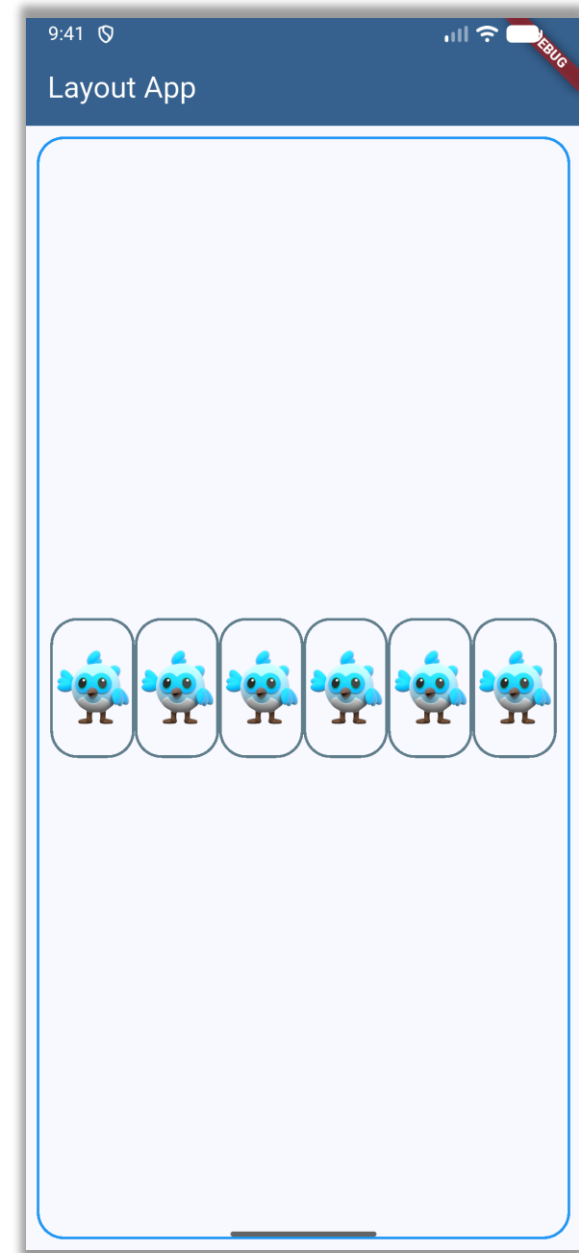
- Dictate how much space a widget should take up relative to its siblings

```
child: Row(  
  mainAxisAlignment: MainAxisAlignment.spaceEvenly,  
  crossAxisAlignment: CrossAxisAlignment.center,  
  children: [  
    Expanded(child: BorderedImage()),  
    Expanded(child: BorderedImage()),  
    Expanded(child: BorderedImage()),  
    Expanded(child: BorderedImage()),  
  ],  
) , // Row
```



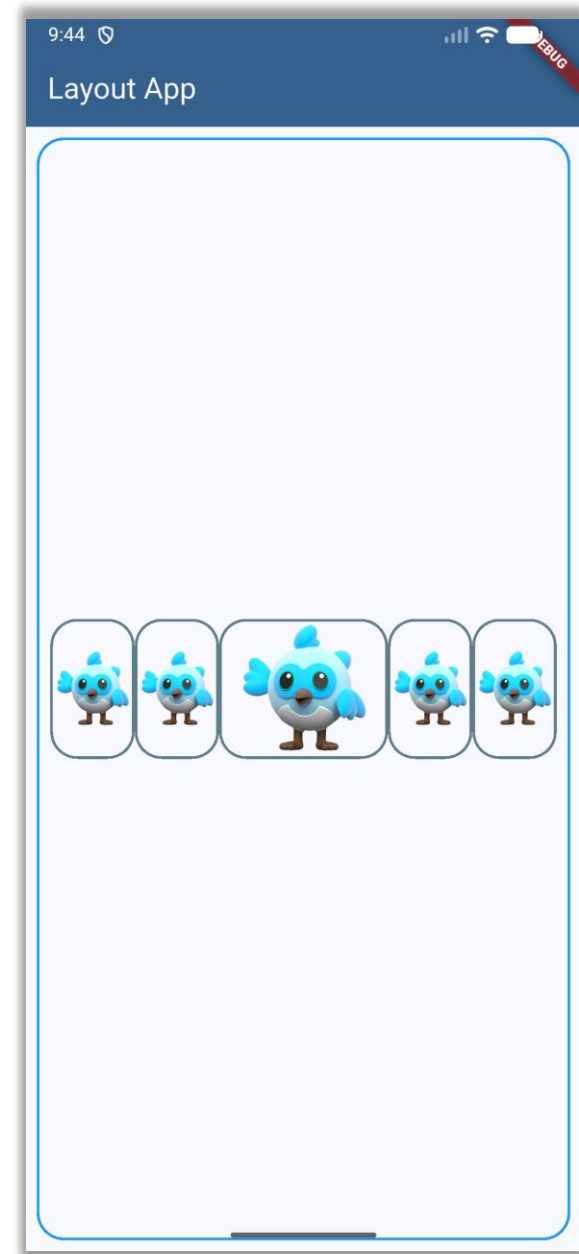
Expanded Widget

```
child: Row(  
  mainAxisAlignment: MainAxisAlignment.spaceEvenly,  
  crossAxisAlignment: CrossAxisAlignment.center,  
  children: [  
    Expanded(child: BorderedImage()),  
    Expanded(child: BorderedImage()),  
    Expanded(child: BorderedImage()),  
    Expanded(child: BorderedImage()),  
    Expanded(child: BorderedImage()),  
    Expanded(child: BorderedImage()),  
  ],  
) , // Row
```



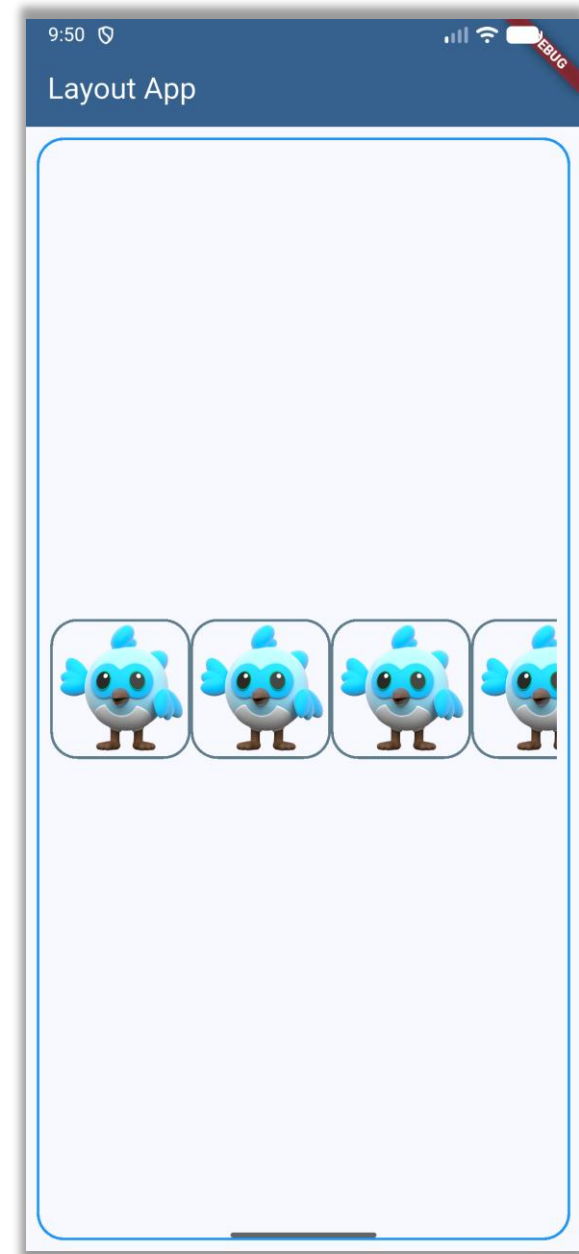
Expanded Widget flex property

```
child: Row(  
  mainAxisAlignment: MainAxisAlignment.spaceEvenly,  
  crossAxisAlignment: CrossAxisAlignment.center,  
  children: [  
    Expanded(child: BorderedImage()),  
    Expanded(child: BorderedImage()),  
    Expanded(flex: 2, child: BorderedImage()),  
    Expanded(child: BorderedImage()),  
    Expanded(child: BorderedImage()),  
  ],  
), // Row
```



Scrolling

```
child: SingleChildScrollView(  
  scrollDirection: Axis.horizontal,  
  child: Row(  
    mainAxisAlignment: MainAxisAlignment.spaceEvenly,  
    crossAxisAlignment: CrossAxisAlignment.center,  
    children: [  
      BorderedImage(),  
      BorderedImage(),  
      BorderedImage(),  
      BorderedImage(),  
      BorderedImage(),  
    ],  
  ), // Row  
) // SingleChildScrollView
```



References

- <https://docs.flutter.dev/get-started/fundamentals/widgets>
- <https://m3.material.io/components/app-bars/overview>
- <https://m3.material.io/components/navigation-bar/overview>
- <https://m3.material.io/components/navigation-drawer/overview>
- <https://m3.material.io/components/bottom-sheets/overview>
- <https://docs.flutter.dev/get-started/fundamentals/layout>
- <https://docs.flutter.dev/ui/widgets/layout>
- <https://github.com/mahdinazmi/Flutter-Basics>