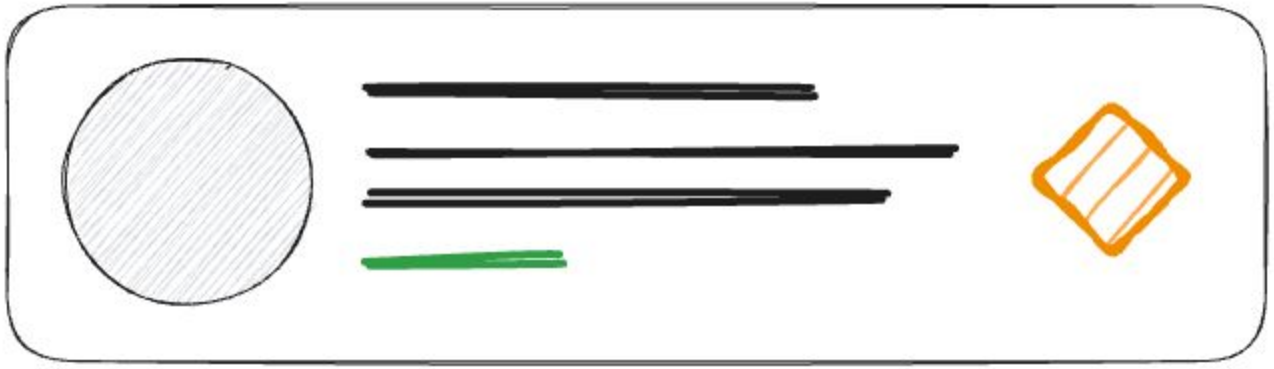
LeanCode

Flutter intro / Layouts 2

flexin’, scrollin’, stackin’, navigatin’

🤸 Flex - simple linear layout

Flex - examples



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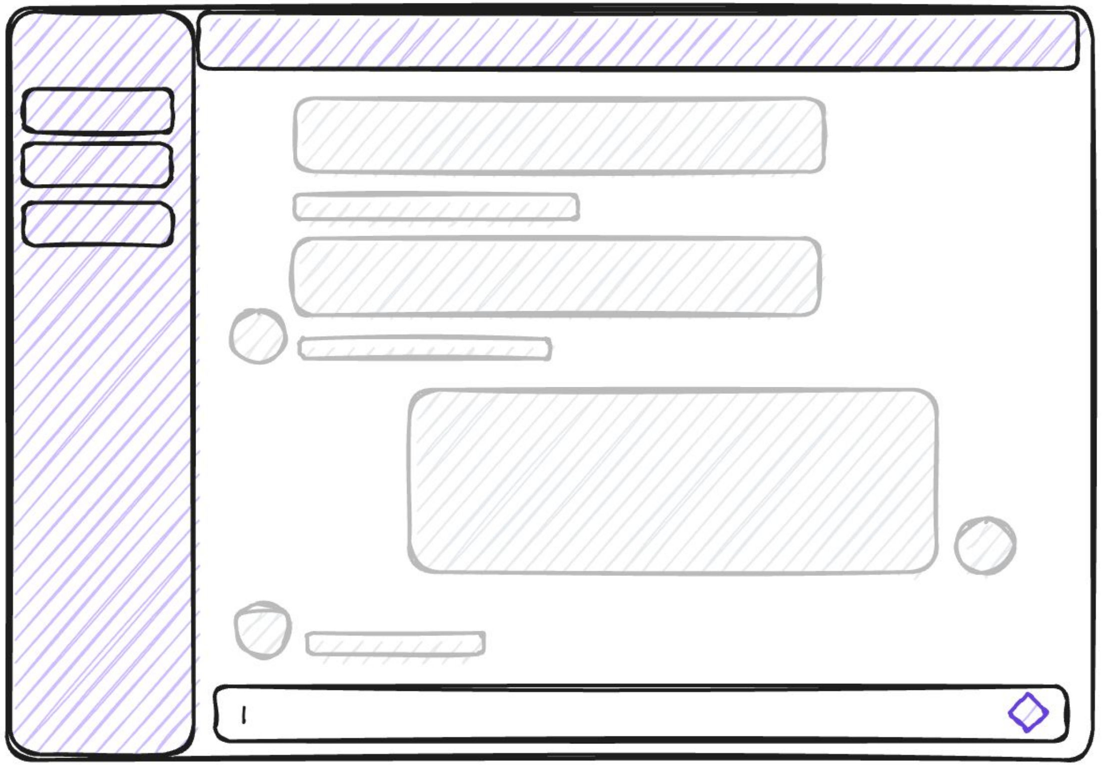
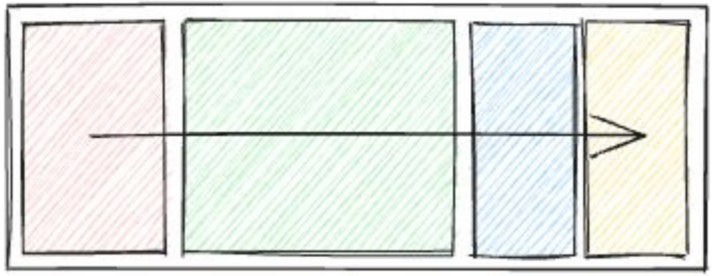
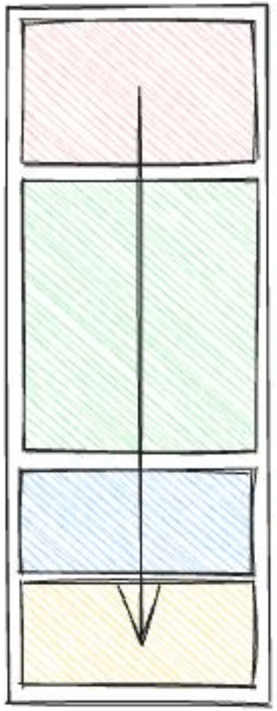
Flex - examples

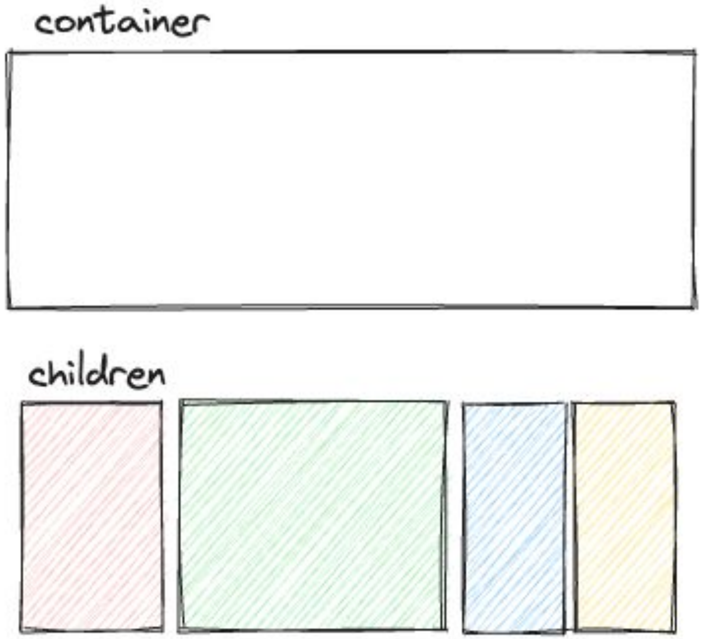


Flex - one-dimensional layouts

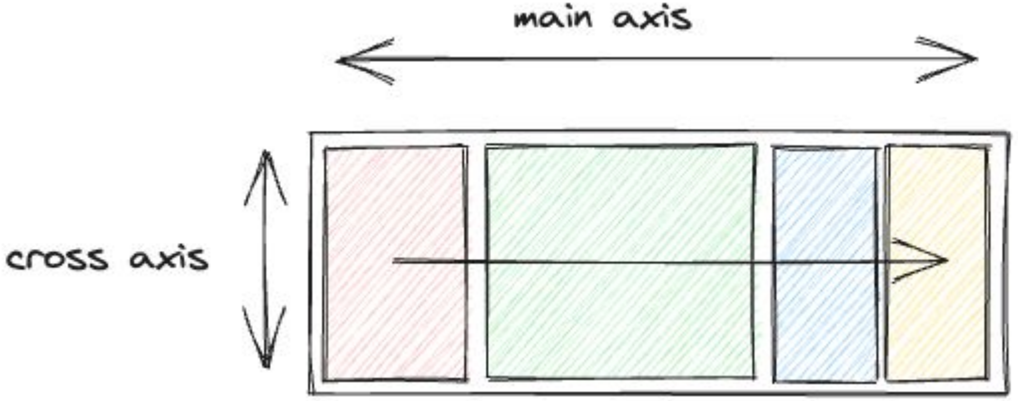


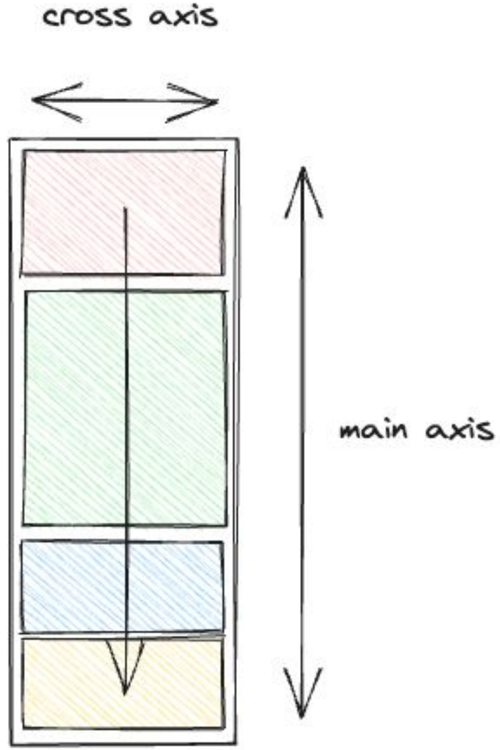


Flex - components

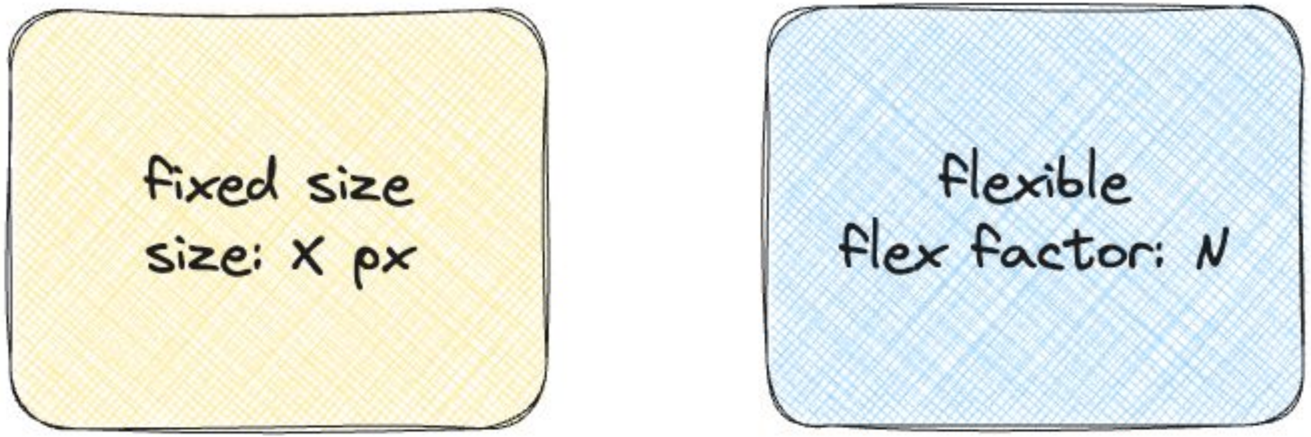


Flex - axes

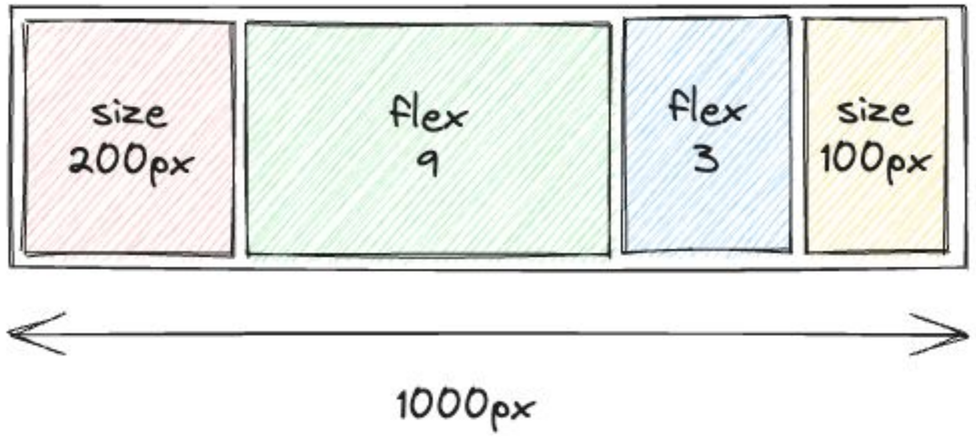




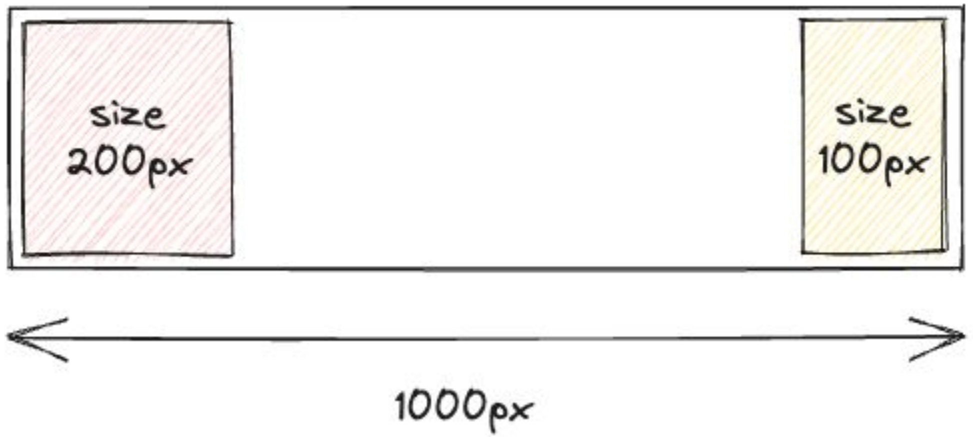
Flex - child item types



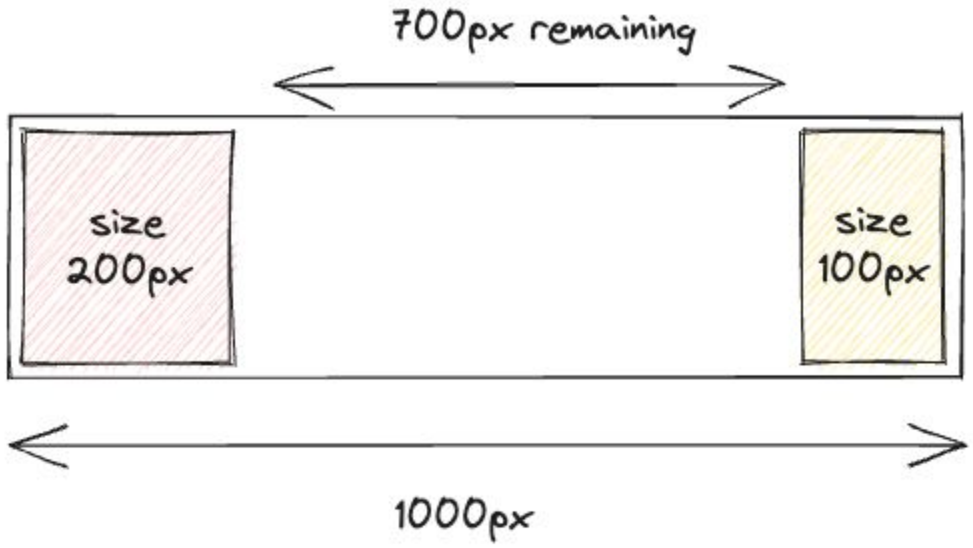
Flex - algorithm



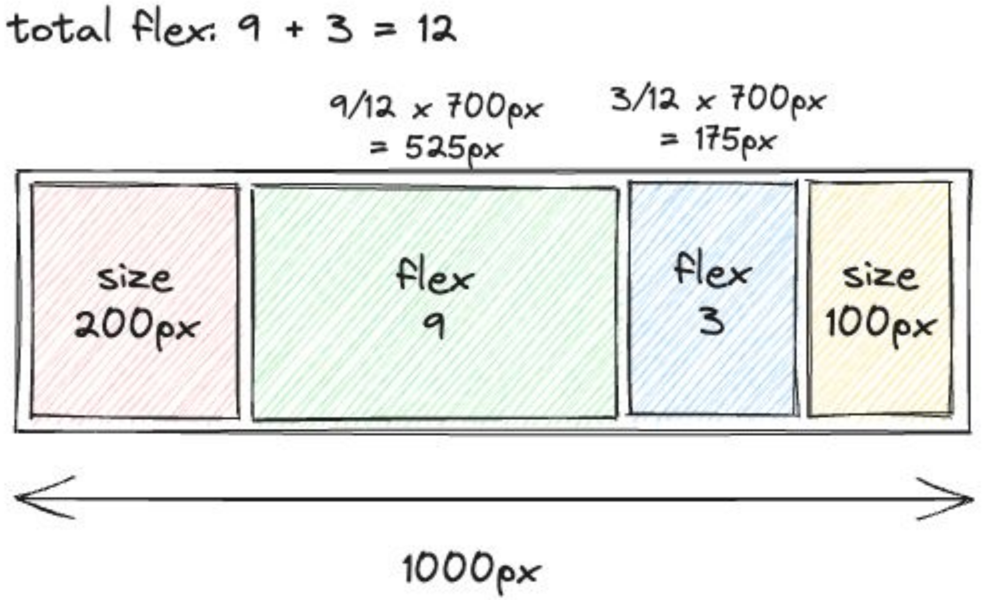
Flex - algorithm



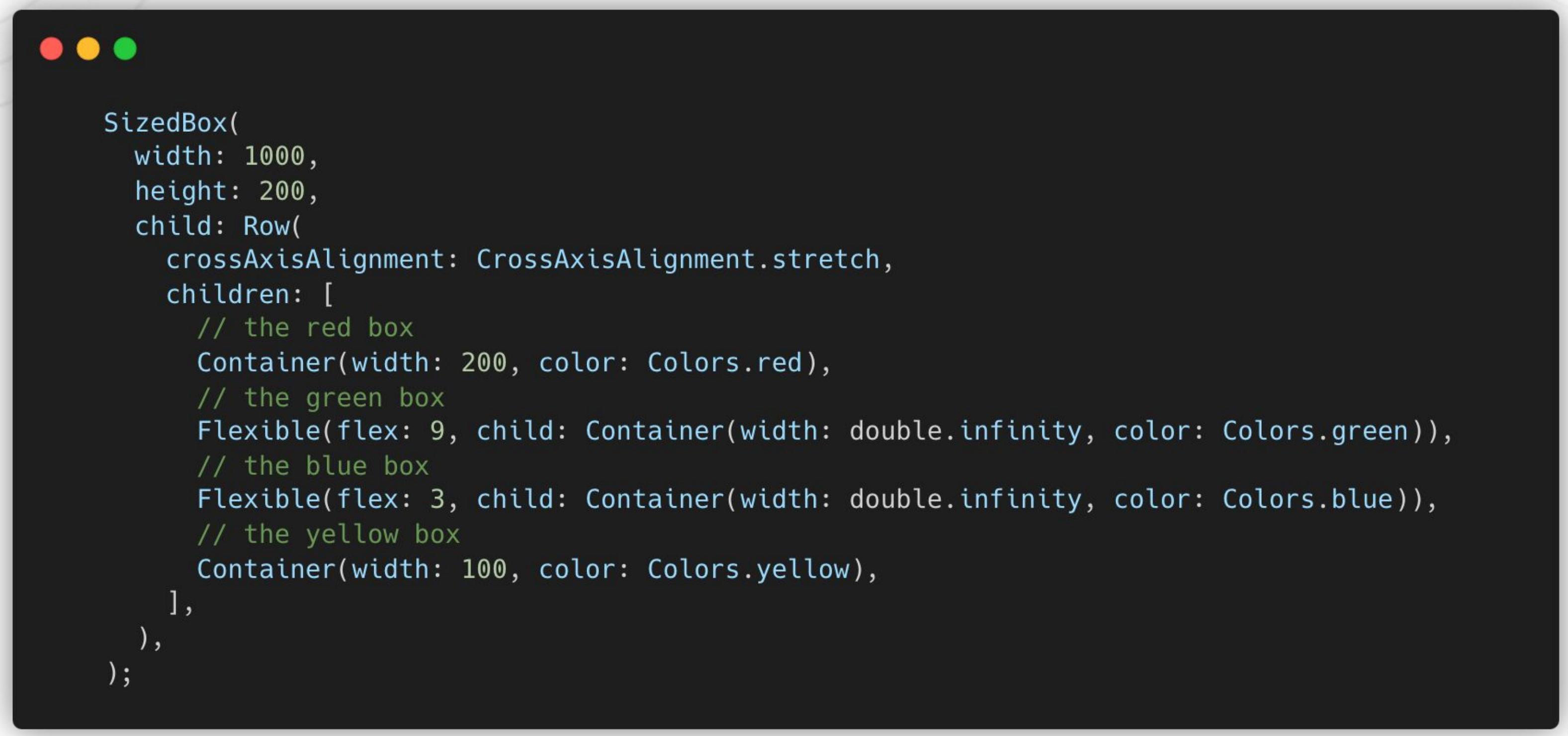
Flex - algorithm



Flex - algorithm

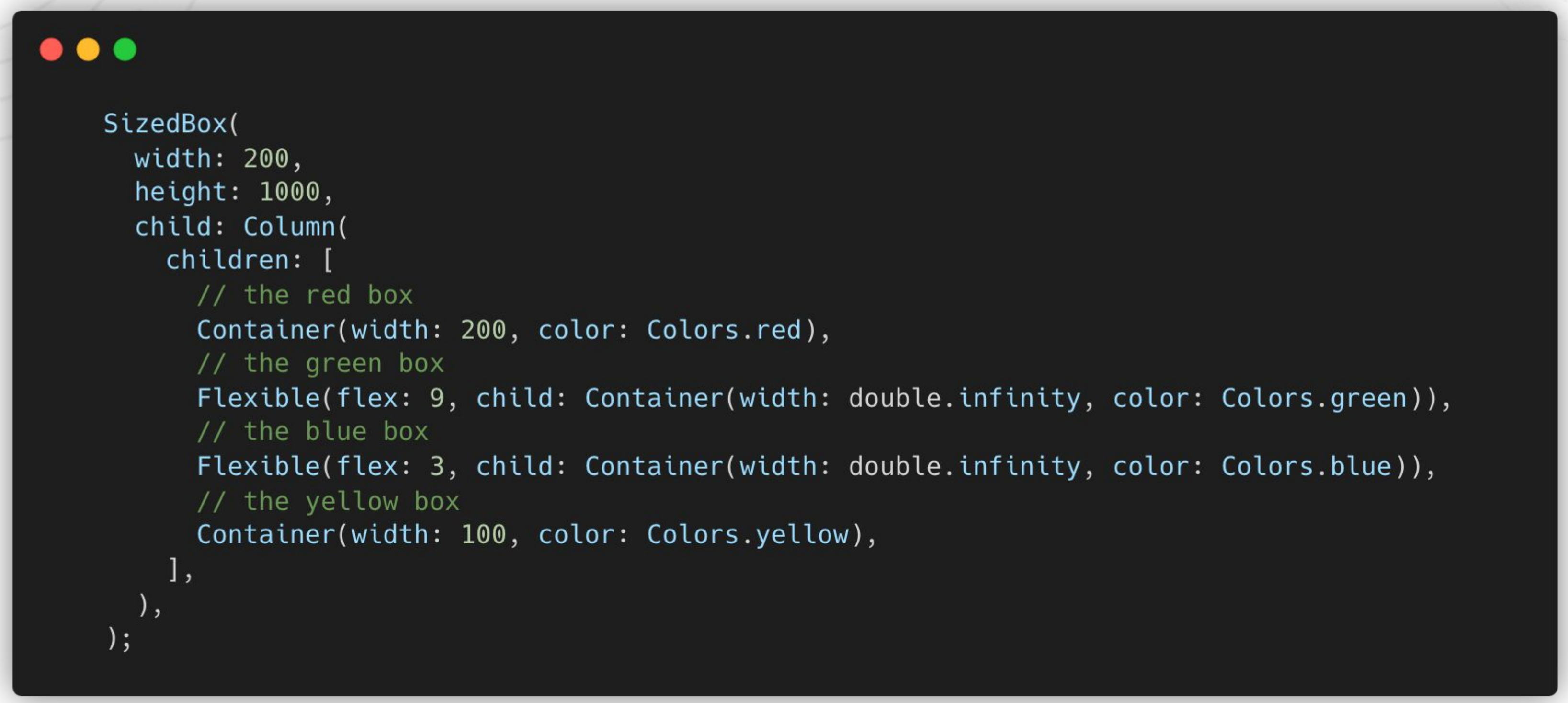


Flex - code



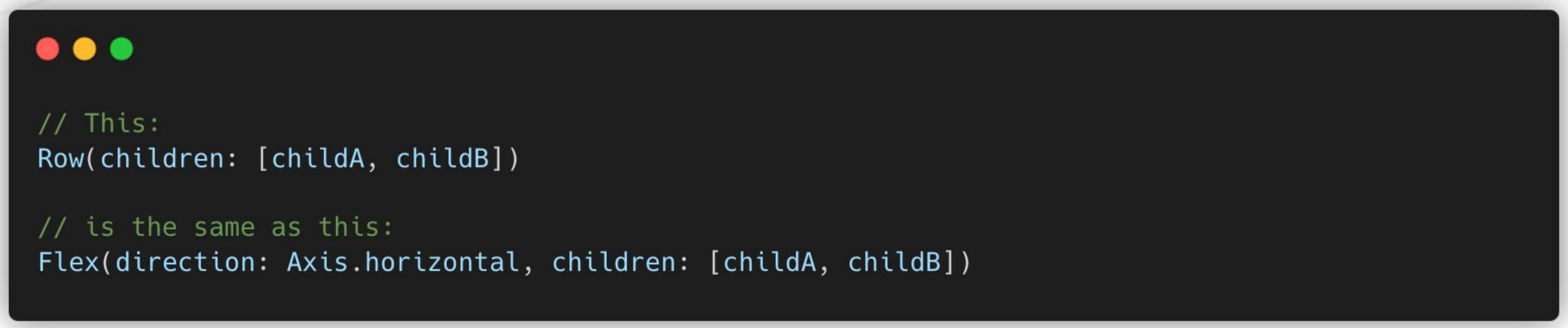
```
SizedBox(
  width: 1000,
  height: 200,
  child: Row(
    crossAxisAlignment: CrossAxisAlignment.stretch,
    children: [
      // the red box
      Container(width: 200, color: Colors.red),
      // the green box
      Flexible(flex: 9, child: Container(width: double.infinity, color: Colors.green)),
      // the blue box
      Flexible(flex: 3, child: Container(width: double.infinity, color: Colors.blue)),
      // the yellow box
      Container(width: 100, color: Colors.yellow),
    ],
  ),
);
```

Flex - code



```
SizedBox(
  width: 200,
  height: 1000,
  child: Column(
    children: [
      // the red box
      Container(width: 200, color: Colors.red),
      // the green box
      Flexible(flex: 9, child: Container(width: double.infinity, color: Colors.green)),
      // the blue box
      Flexible(flex: 3, child: Container(width: double.infinity, color: Colors.blue)),
      // the yellow box
      Container(width: 100, color: Colors.yellow),
    ],
  ),
);
```

Flex - code



```
// This:
Row(children: [childA, childB])

// is the same as this:
Flex(direction: Axis.horizontal, children: [childA, childB])
```

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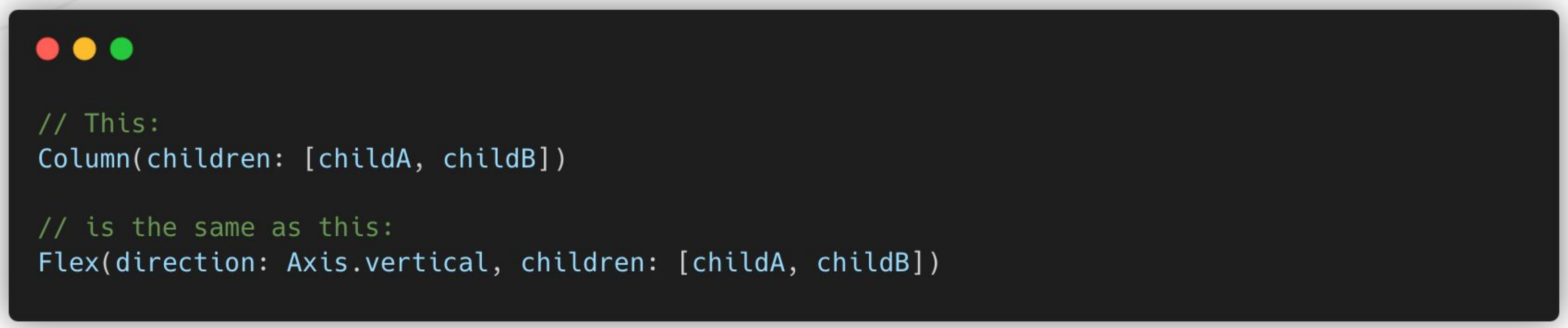
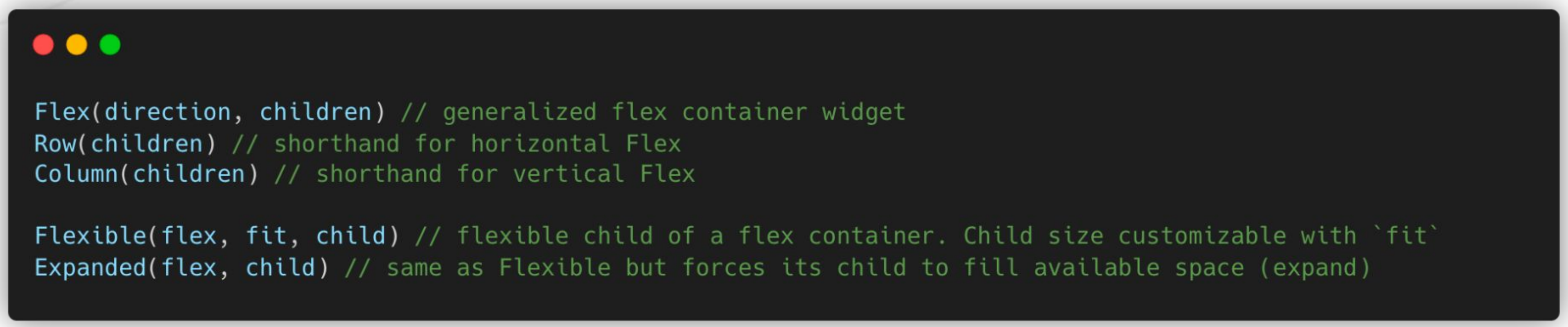
Flex - code



```
// This:
Column(children: [childA, childB])

// is the same as this:
Flex(direction: Axis.vertical, children: [childA, childB])
```

Flex - widget overview



```
Flex(direction, children) // generalized flex container widget
Row(children) // shorthand for horizontal Flex
Column(children) // shorthand for vertical Flex

Flexible(flex, fit, child) // flexible child of a flex container. Child size customizable with `fit`
Expanded(flex, child) // same as Flexible but forces its child to fill available space (expand)
```

Problem: none of this is scrollable

📝 Lists & friends

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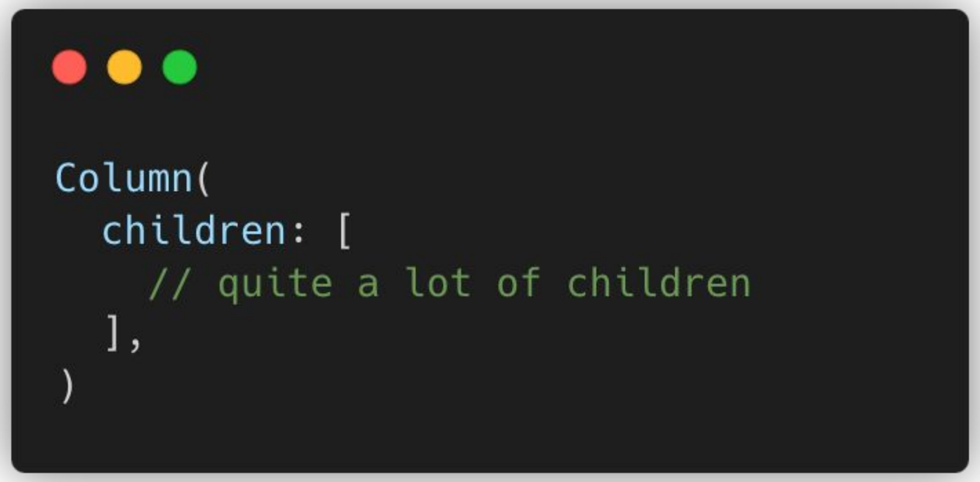
ScrollViews overview

SingleChildScrollView

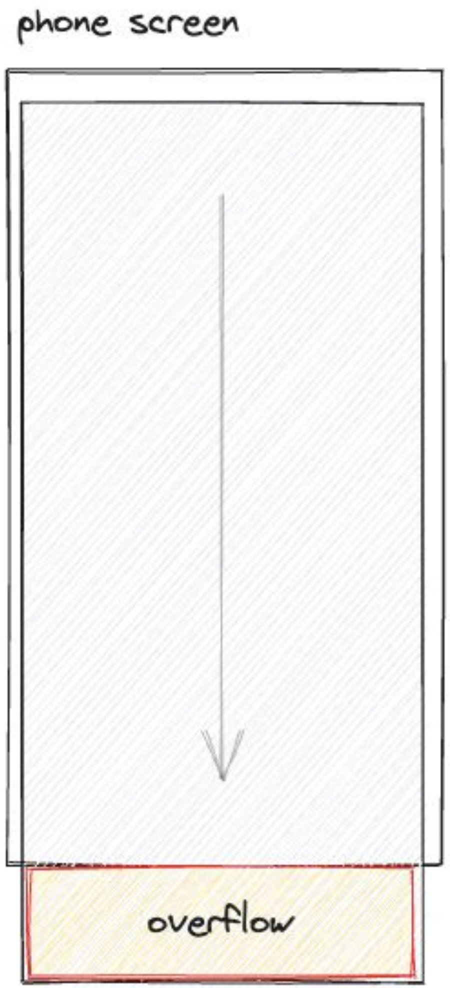
does not fit :(

no scroll :/

overflow error 😱



```
Column(
  children: [
    // quite a lot of children
  ],
)
```



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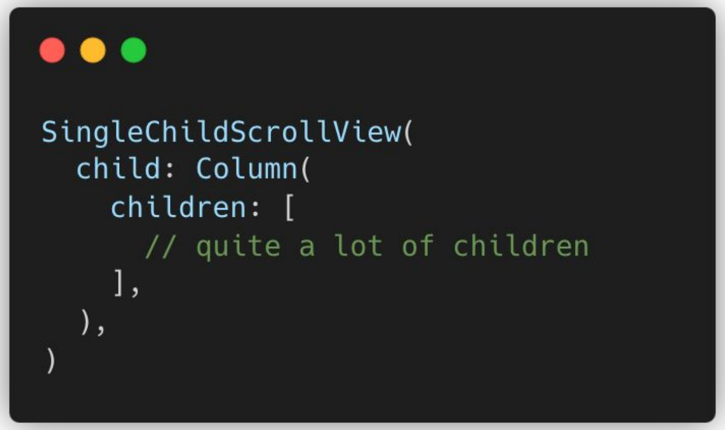
SingleChildScrollView

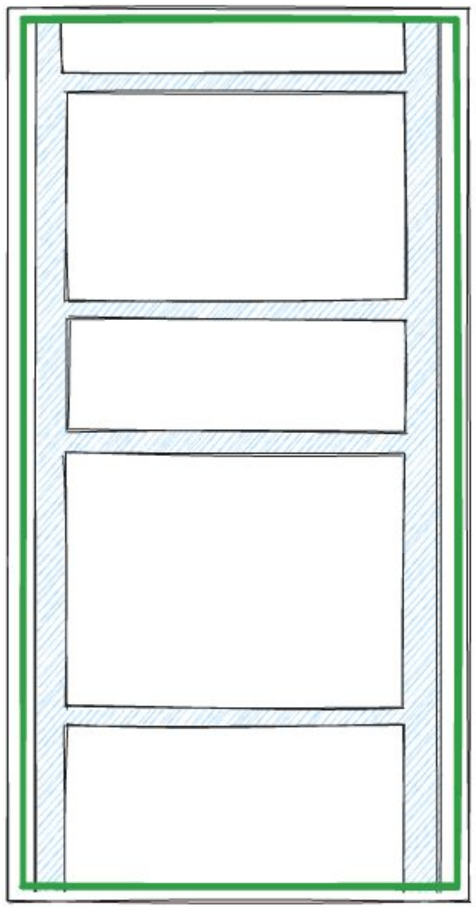
yes scroll 😎

still does not fit but in a good way :)

no overflow error :hackerman:



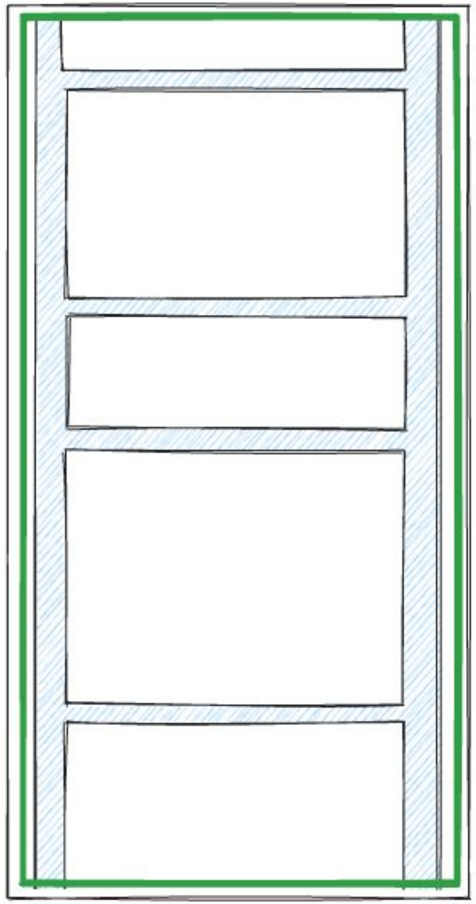
```
SingleChildScrollView(
  child: Column(
    children: [
      // quite a lot of children
    ],
  ),
)
```



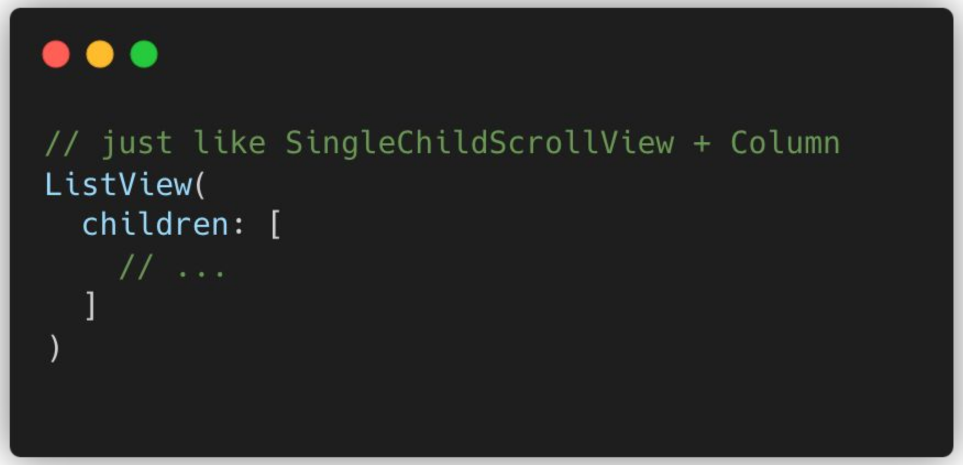
Fajrant

ListView

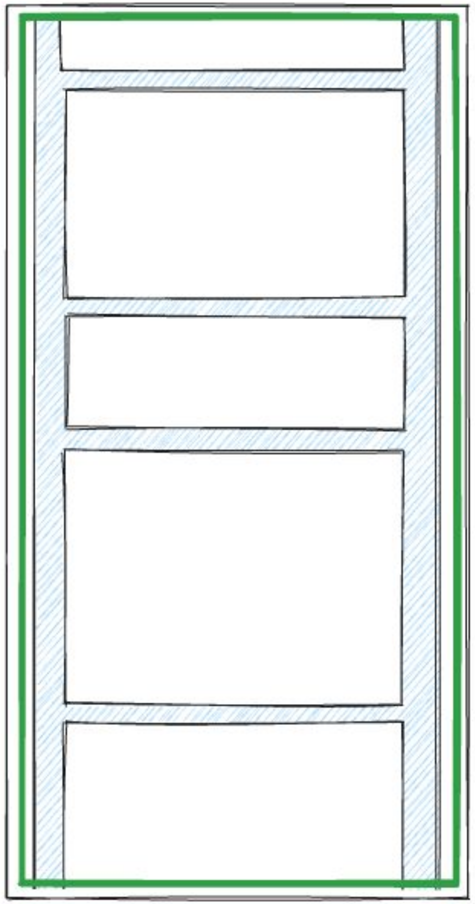
- better performance in long list setups
- provides quality of life helpers for working with lists



50 constructors of ListView



```
// just like SingleChildScrollView + Column
ListView(
  children: [
    // ...
  ]
)
```



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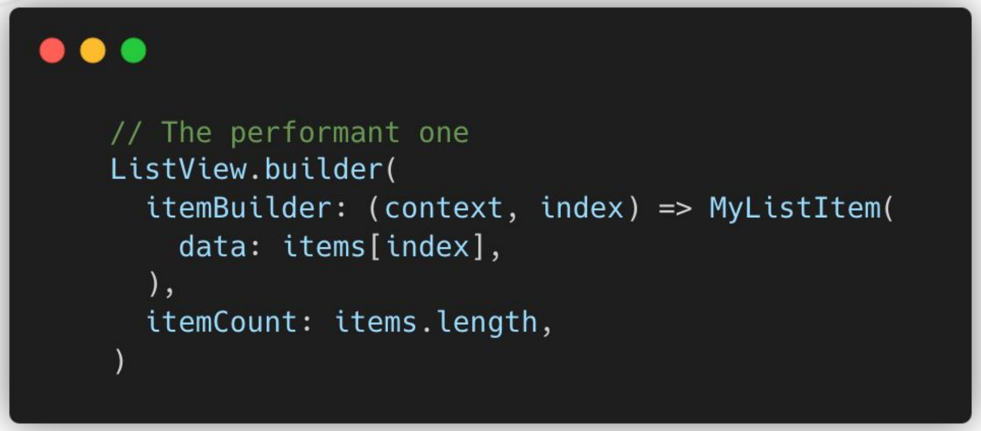
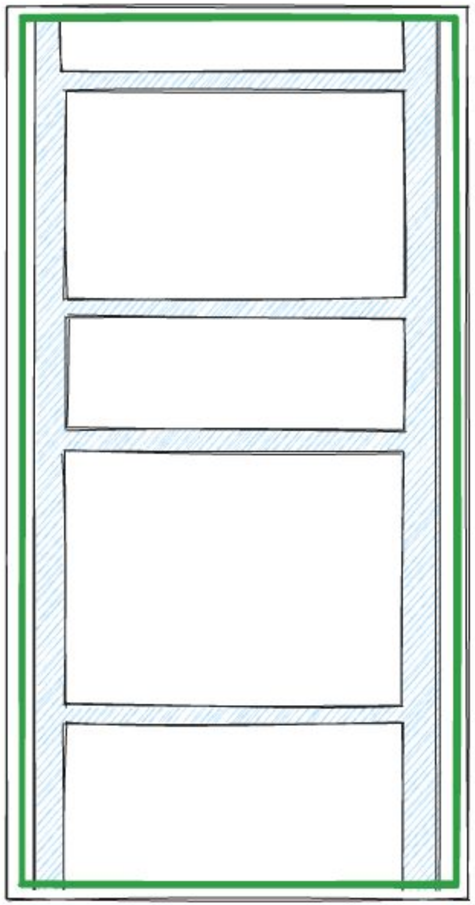
50 constructors of ListView



```
// The performant one
ListView.builder(
  itemBuilder: (context, index) => MyListItem(
    data: items[index],
  ),
  itemCount: items.length,
)
```



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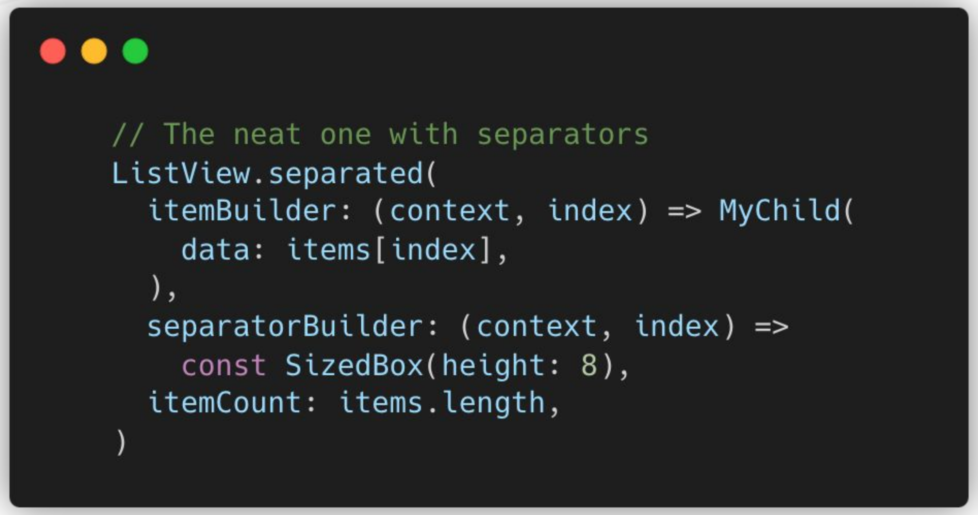
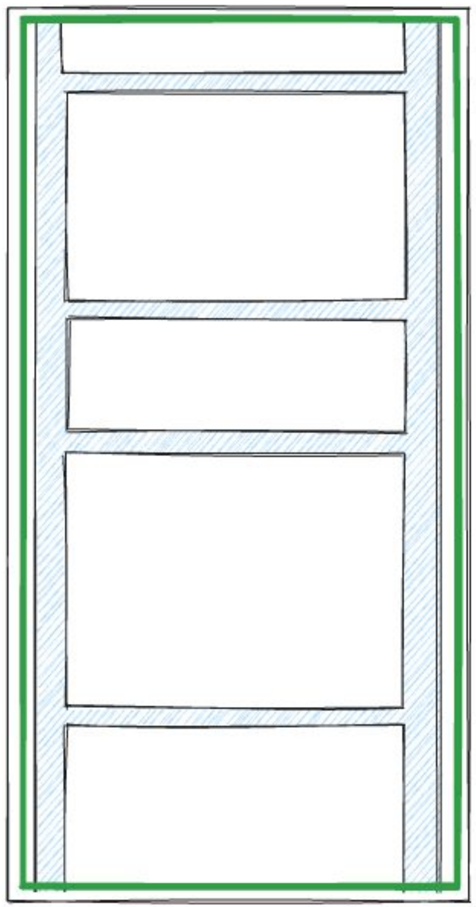
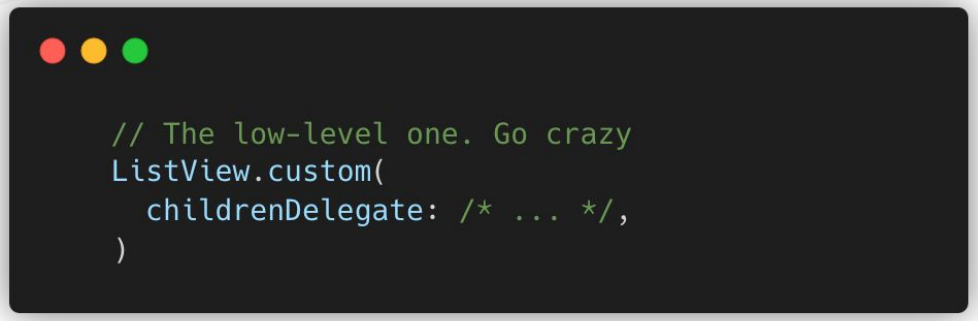
50 constructors of ListView



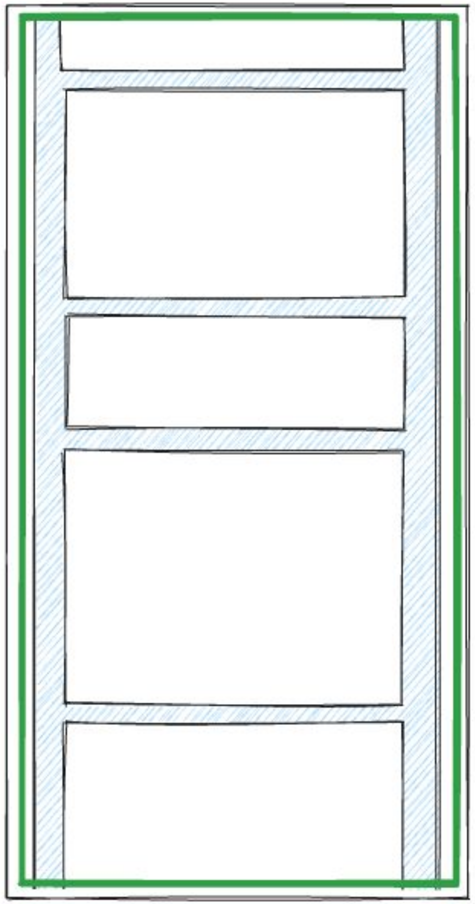
```
// The neat one with separators
ListView.separated(
  itemBuilder: (context, index) => MyChild(
    data: items[index],
  ),
  separatorBuilder: (context, index) =>
    const SizedBox(height: 8),
  itemCount: items.length,
)
```



50 constructors of ListView



```
// The low-level one. Go crazy
ListView.custom(
  childrenDelegate: /* ... */,
)
```



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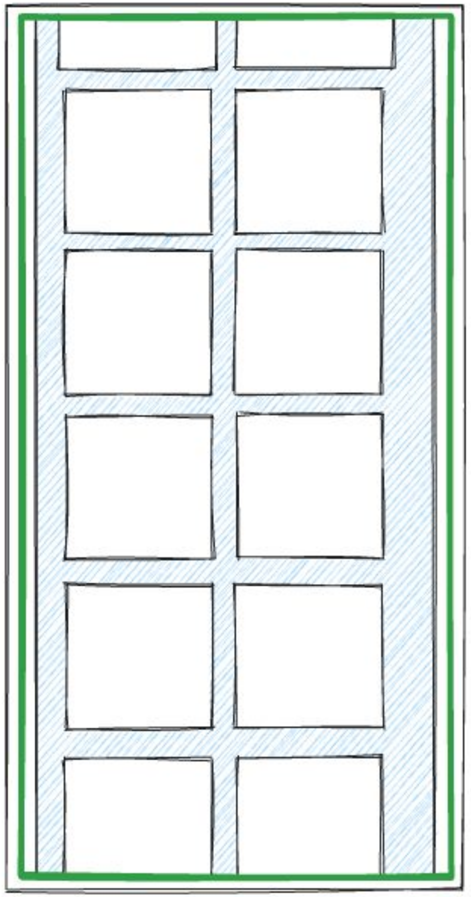
GridView

Same story as with ListView but you get a nice, responsive, even grid



⏱️ Performance

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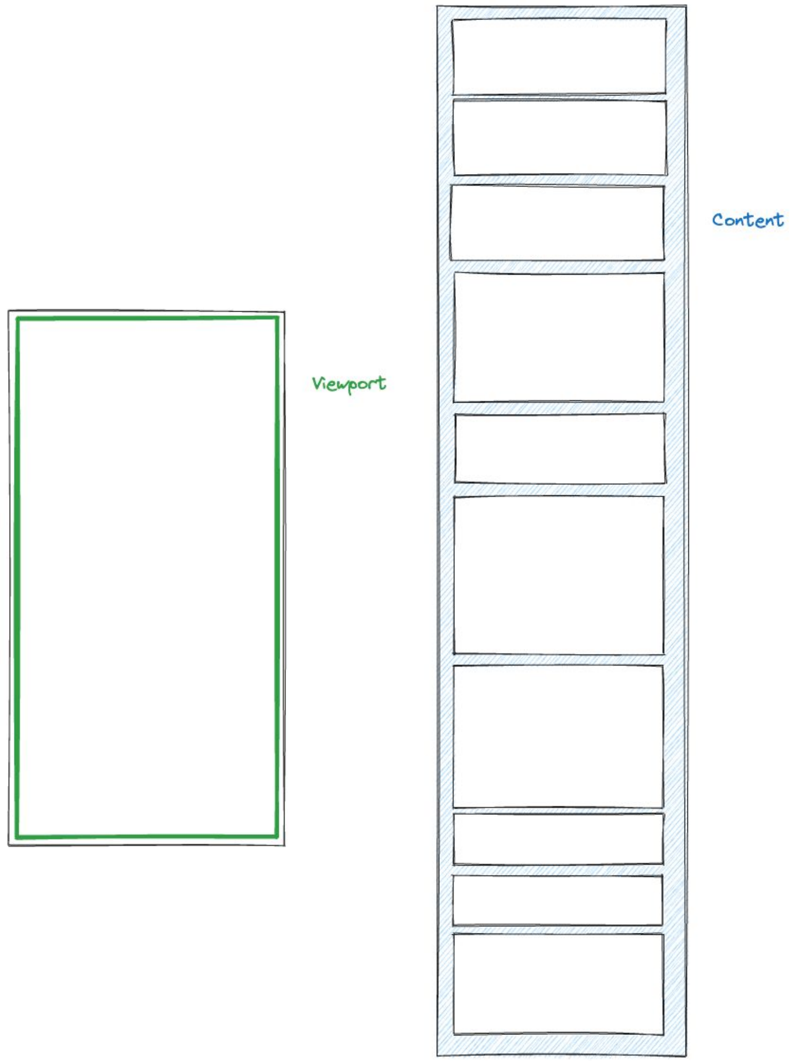
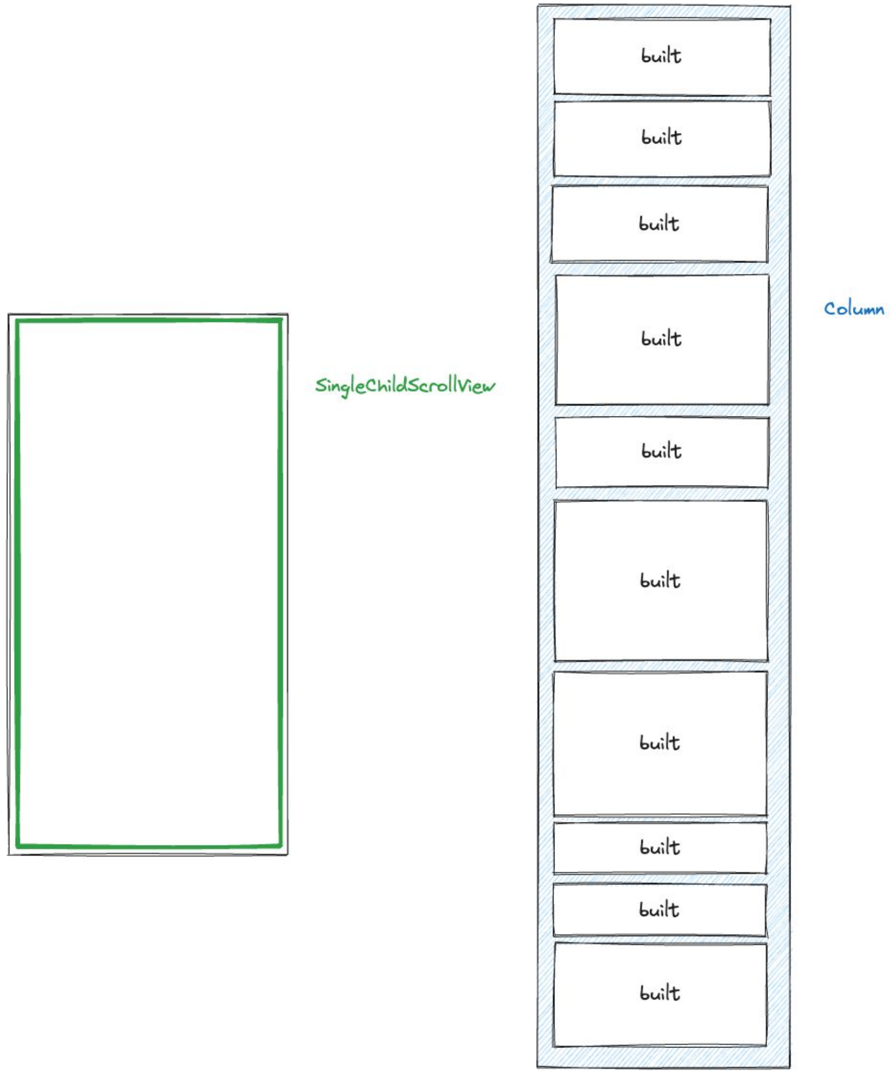
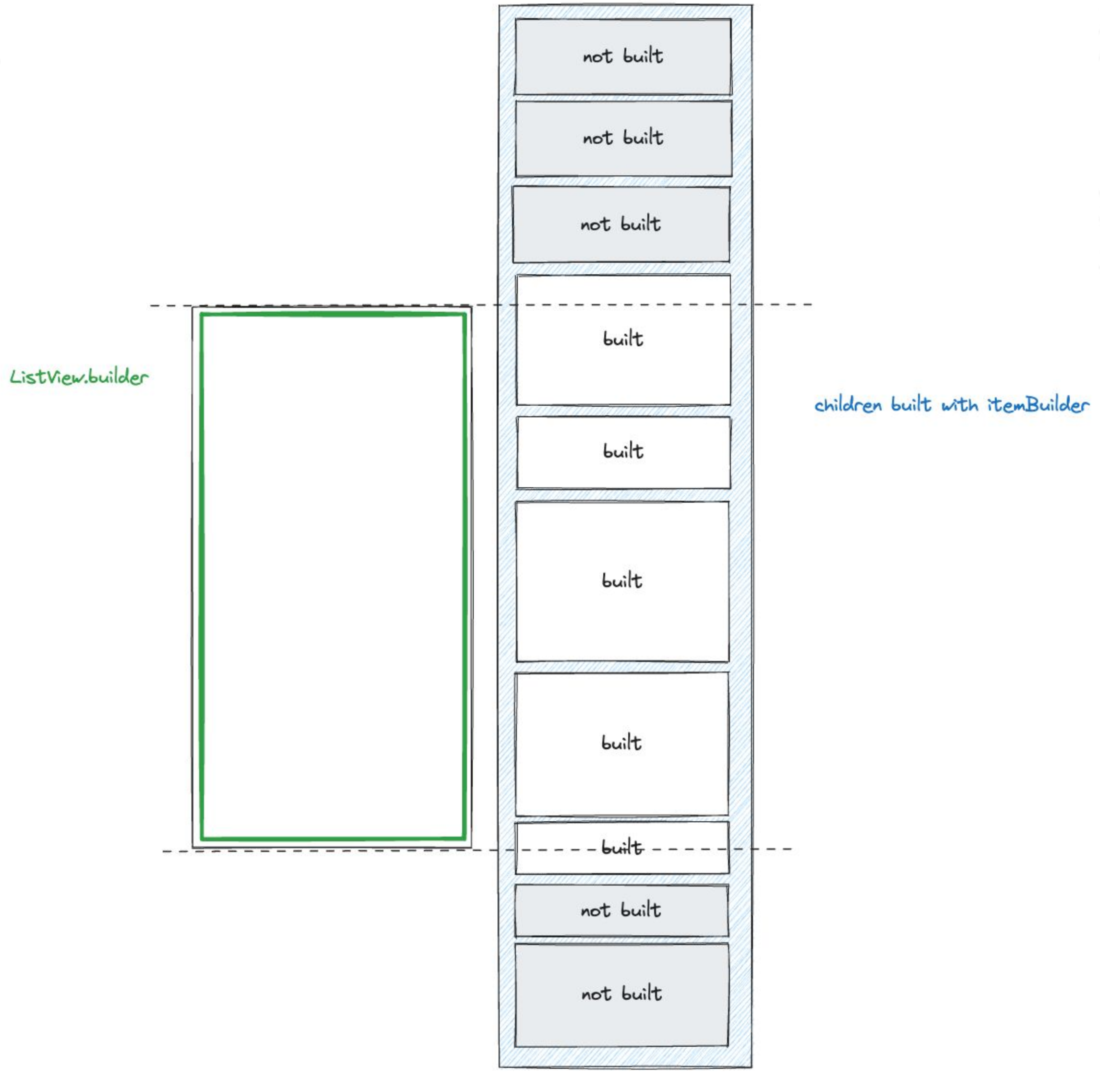
Virtualization



Virtualization

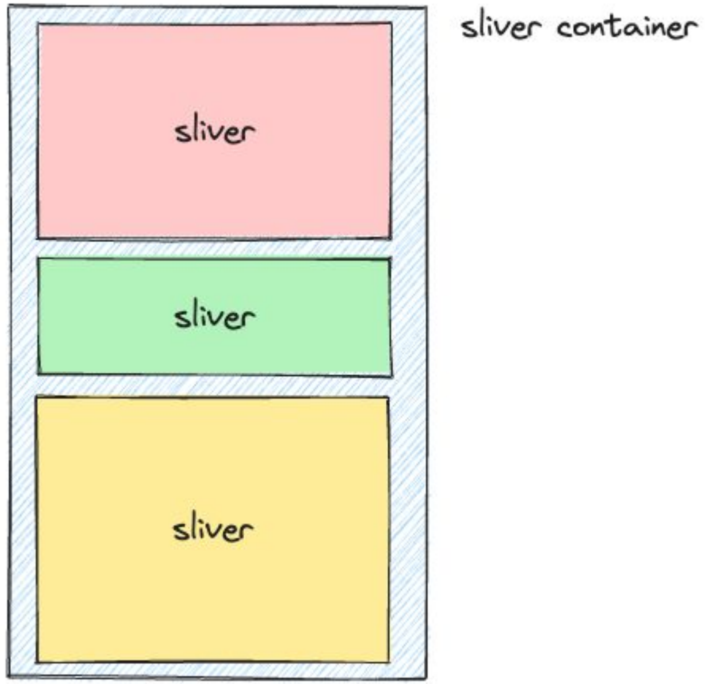


Virtualization



Slivers

ℹ️ Sliver - part of a scrollable view



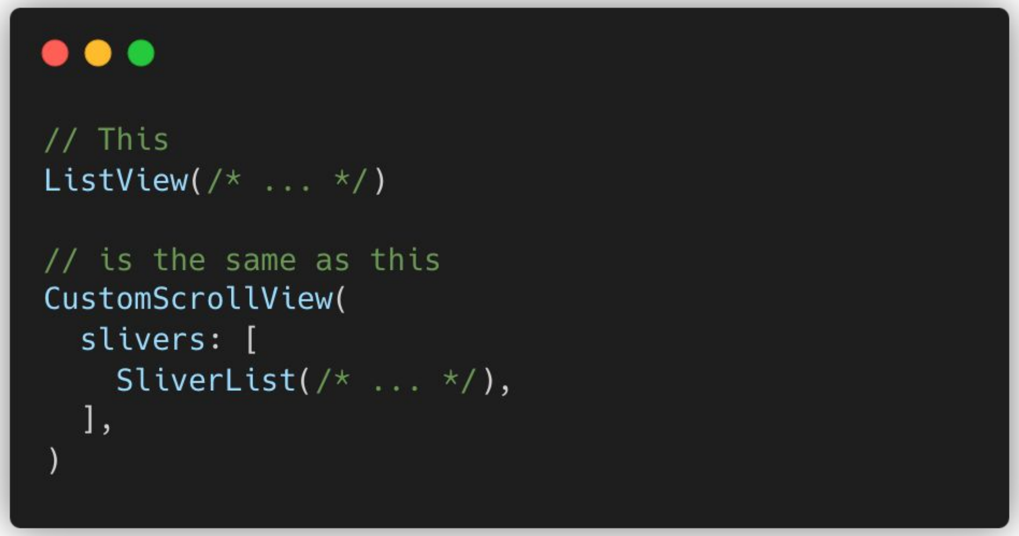
Sliver-related widgets

- SliverList (ListView but as a sliver)
- SliverGrid (GridView sliver)
- CustomScrollView (container for slivers)
- SliverToBoxAdapter (embed a box as a sliver)
- Notable mention: sliver_tools | Flutter Package (pub.dev)

Slivers vs boxes

(Render)Sliver ← incompatible! → (Render)Box

CustomScrollView



```
// This
ListView(/* ... */)

// is the same as this
CustomScrollView(
  slivers: [
    SliverList(/* ... */),
  ],
)
```

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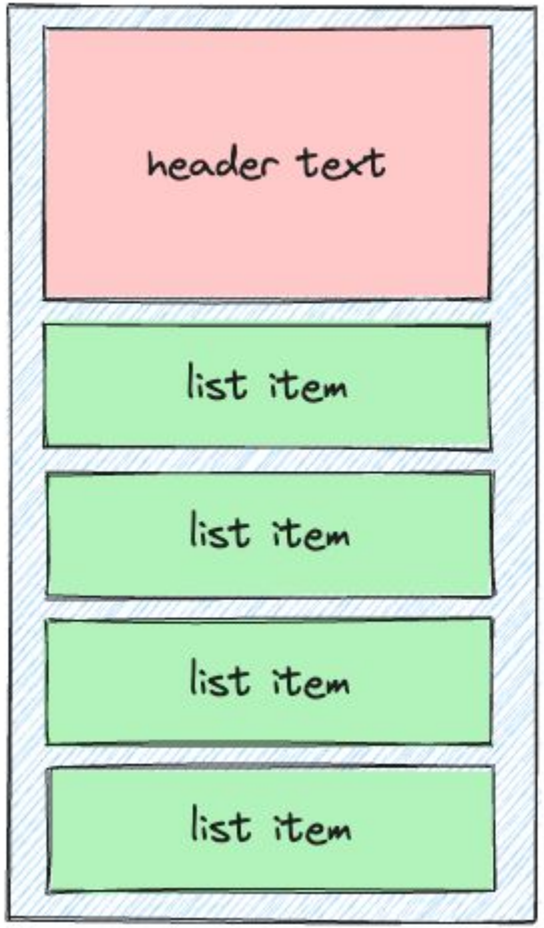
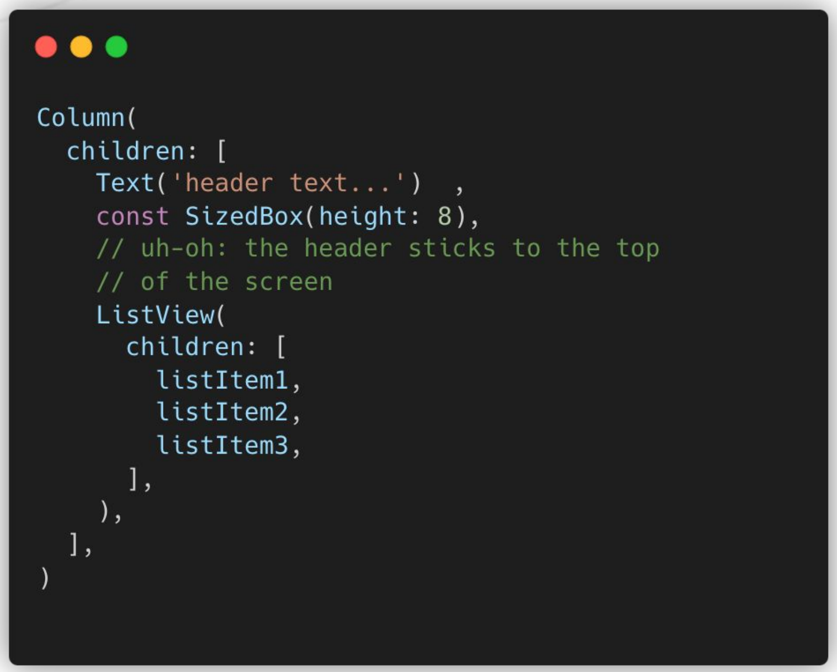
CustomScrollView

How do you go about this?

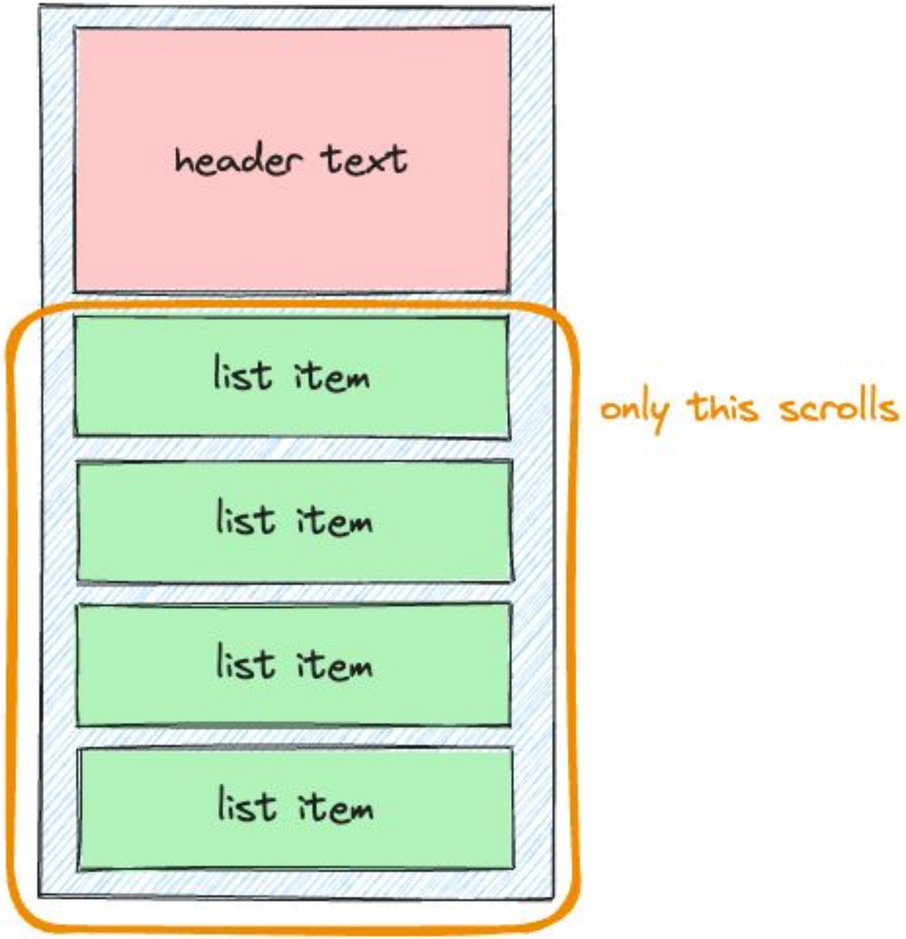


CustomScrollView

How do you go about this?

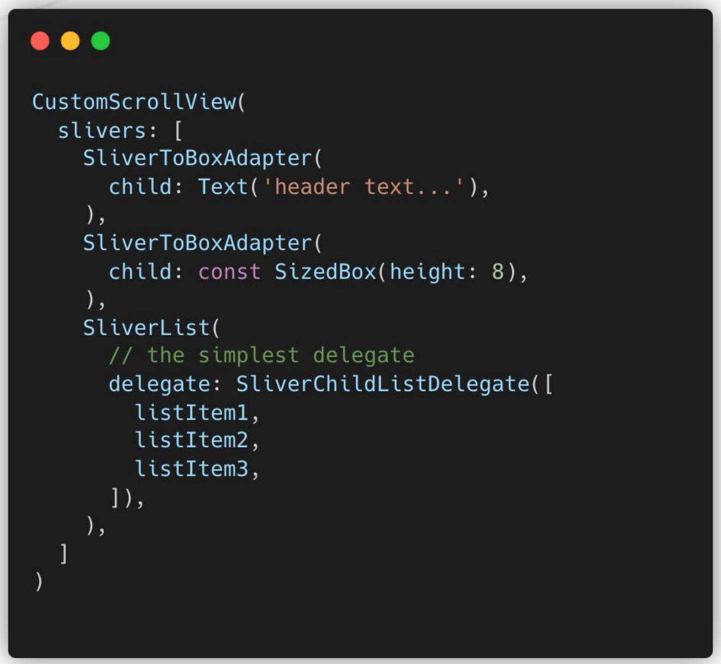


```
Column(
  children: [
    Text('header text...')  ,
    const SizedBox(height: 8),
    // uh-oh: the header sticks to the top
    // of the screen
    ListView(
      children: [
        listItem1,
        listItem2,
        listItem3,
      ],
    ),
  ],
)
```

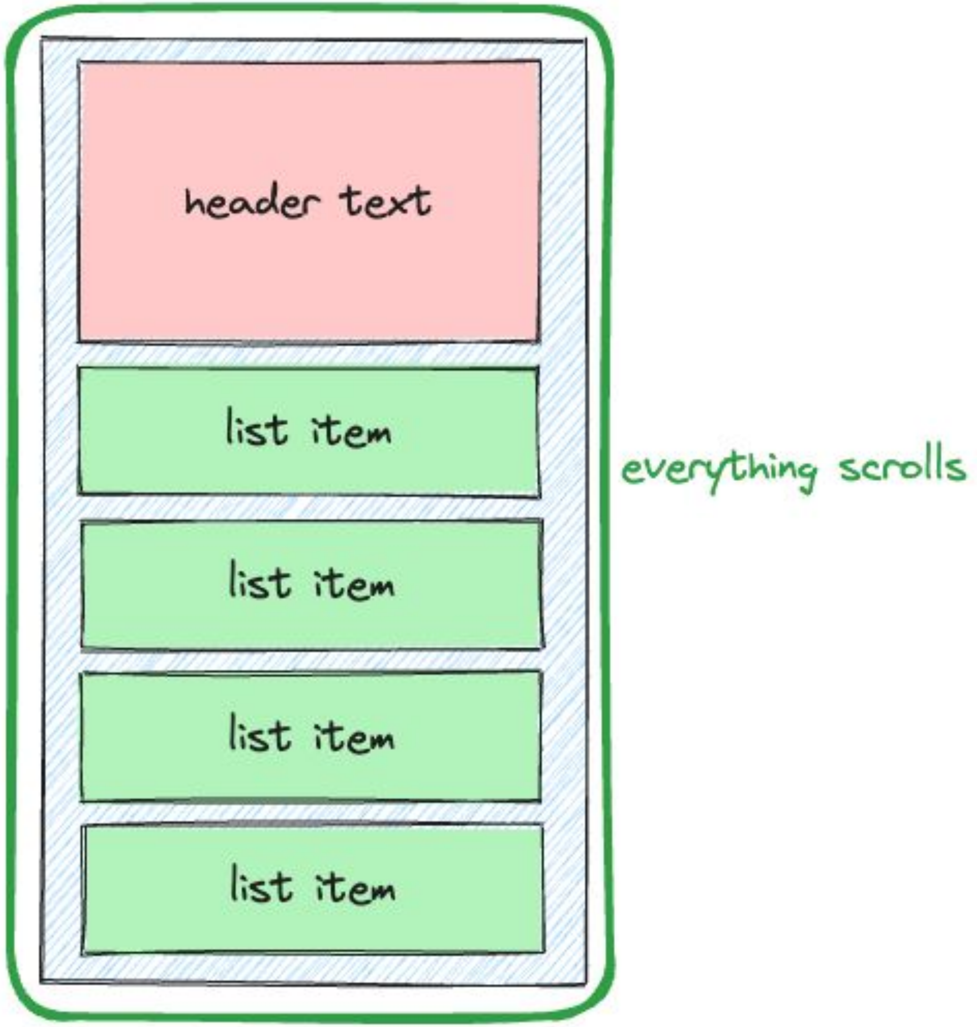


CustomScrollView

How do you go about this?



```
CustomScrollView(
  slivers: [
    SliverToBoxAdapter(
      child: Text('header text...'),
    ),
    SliverToBoxAdapter(
      child: const SizedBox(height: 8),
    ),
    SliverList(
      // the simplest delegate
      delegate: SliverChildListDelegate([
        listItem1,
        listItem2,
        listItem3,
      ]),
    ),
  ]
)
```



🛠️ Other useful widgets

🥞 Stack

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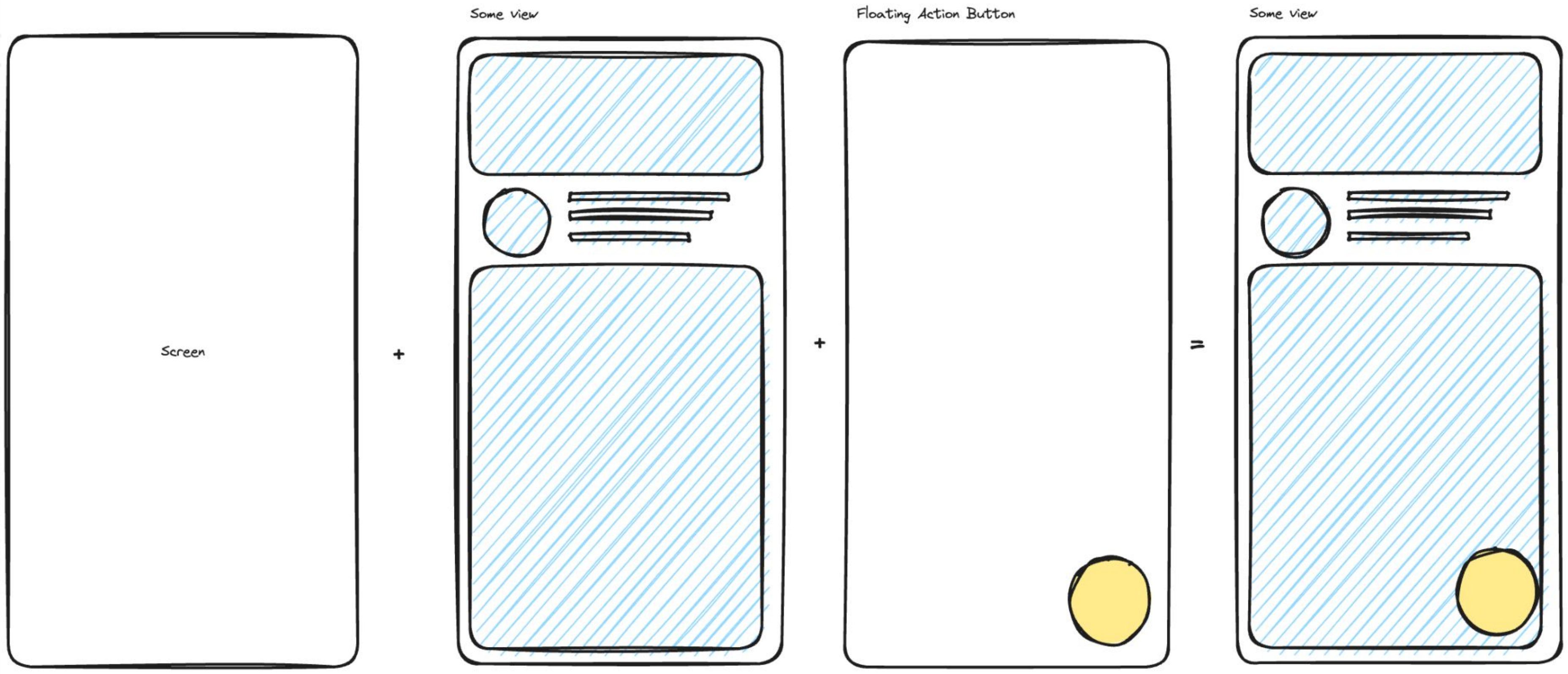
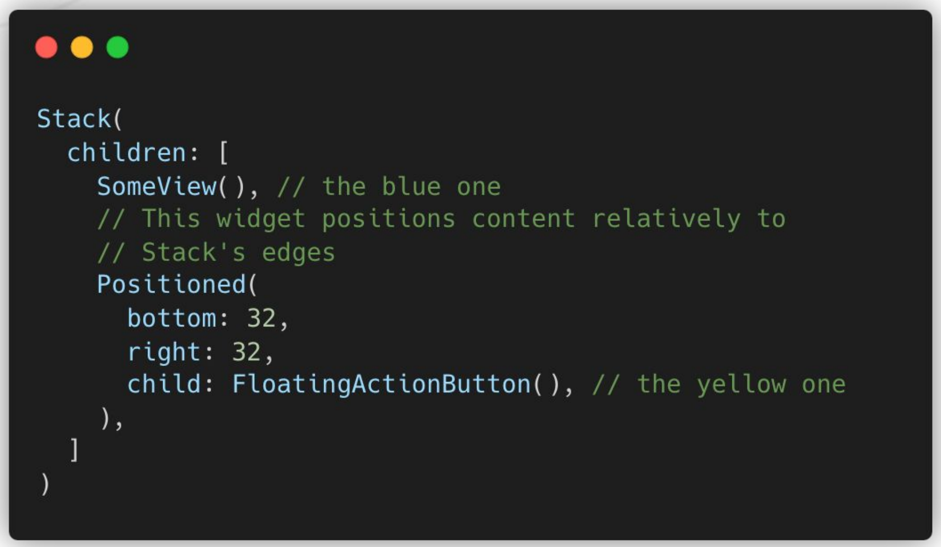
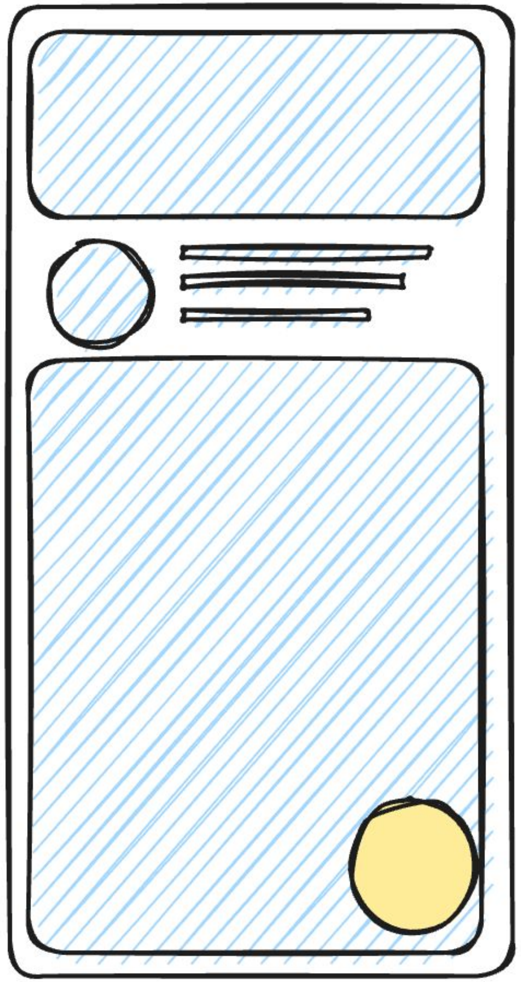
Stack



Stack + Positioned



```
Stack(
  children: [
    SomeView(), // the blue one
    // This widget positions content relatively to
    // Stack's edges
    Positioned(
      bottom: 32,
      right: 32,
      child: FloatingActionButton(), // the yellow one
    ),
  ]
)
```



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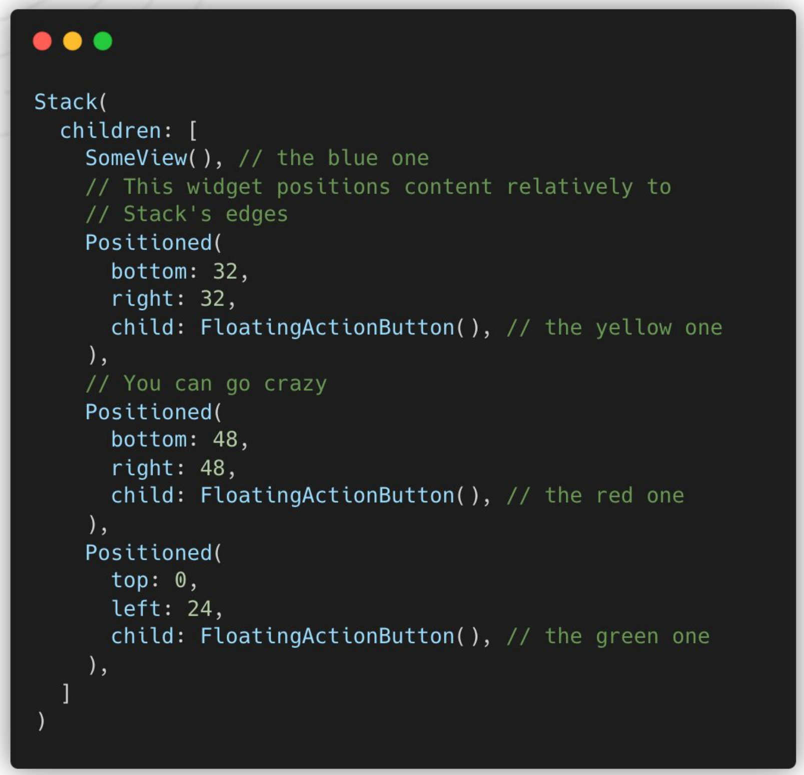
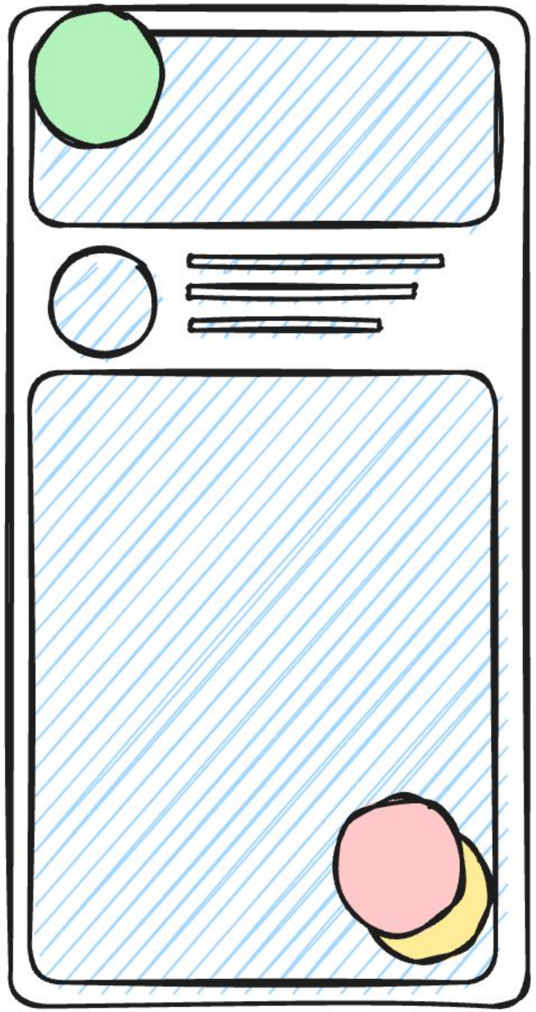
Stack + Positioned



```
Stack(
  children: [
    SomeView(), // the blue one
    // This widget positions content relatively to
    // Stack's edges
    Positioned(
      bottom: 32,
      right: 32,
      child: FloatingActionButton(), // the yellow one
    ),
    // You can go crazy
    Positioned(
      bottom: 48,
      right: 48,
      child: FloatingActionButton(), // the red one
    ),
    Positioned(
      top: 0,
      left: 24,
      child: FloatingActionButton(), // the green one
    ),
  ]
)
```



👆 GestureDetector

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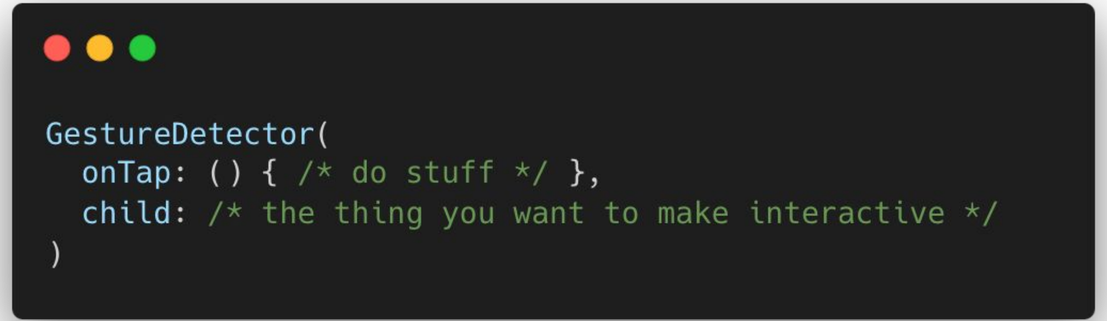
GestureDetector

Handle taps & other gestures

[Taps, drags, and other gestures | Flutter]

[GestureDetector class - widgets library - Dart API (flutter.dev)]

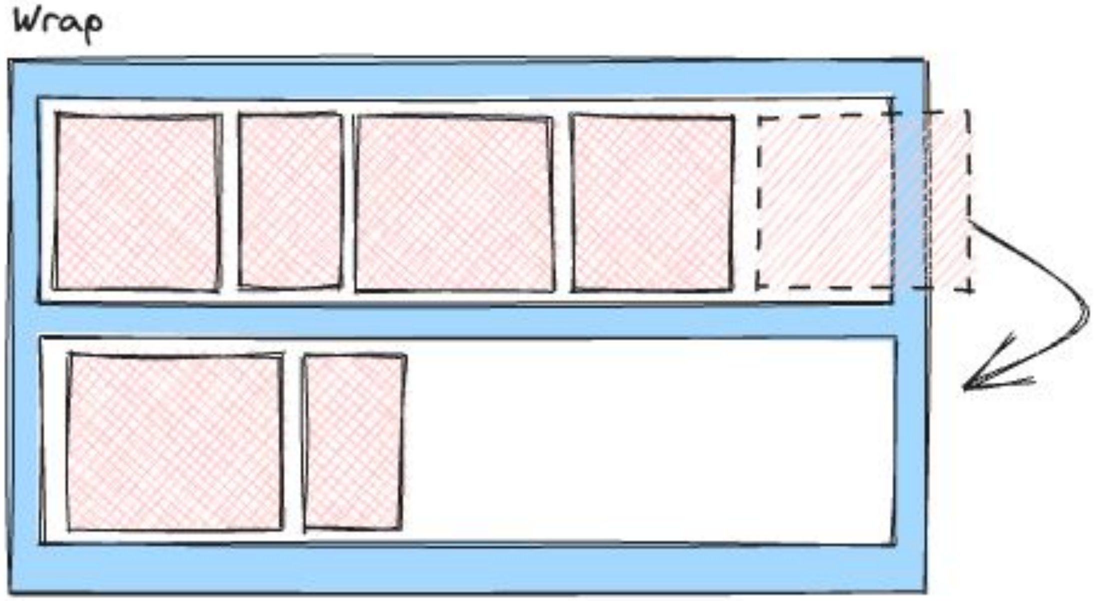


```
GestureDetector(
  onTap: () { /* do stuff */ },
  child: /* the thing you want to make interactive */
)
```

🌯 Wrap

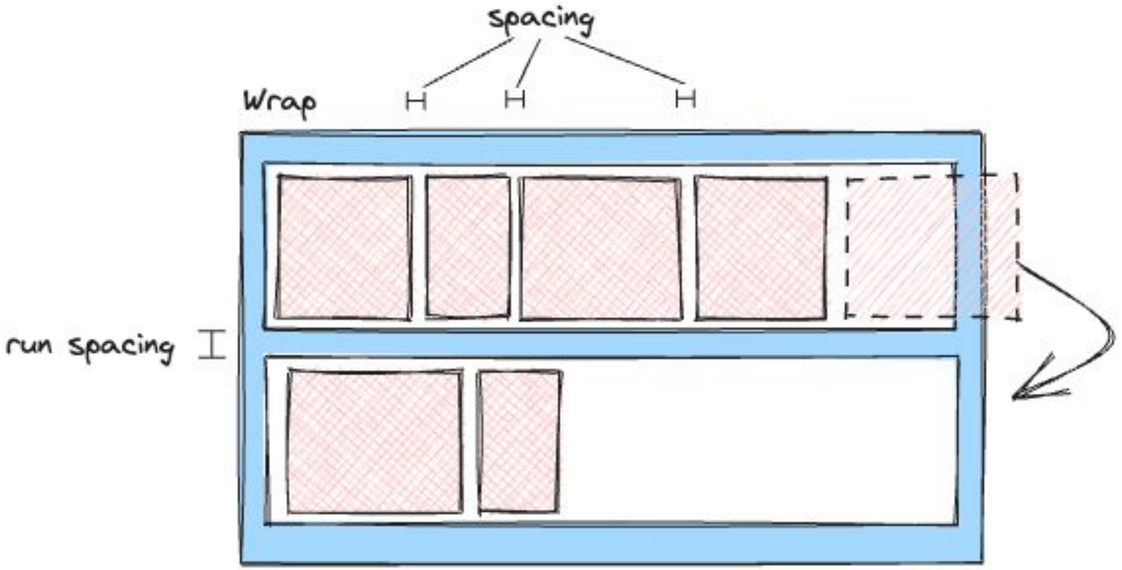
Wrap

It’s a Flex/Row/Column that wraps to the next line/column



Wrap

It’s a Flex/Row/Column that wraps to the next line/column



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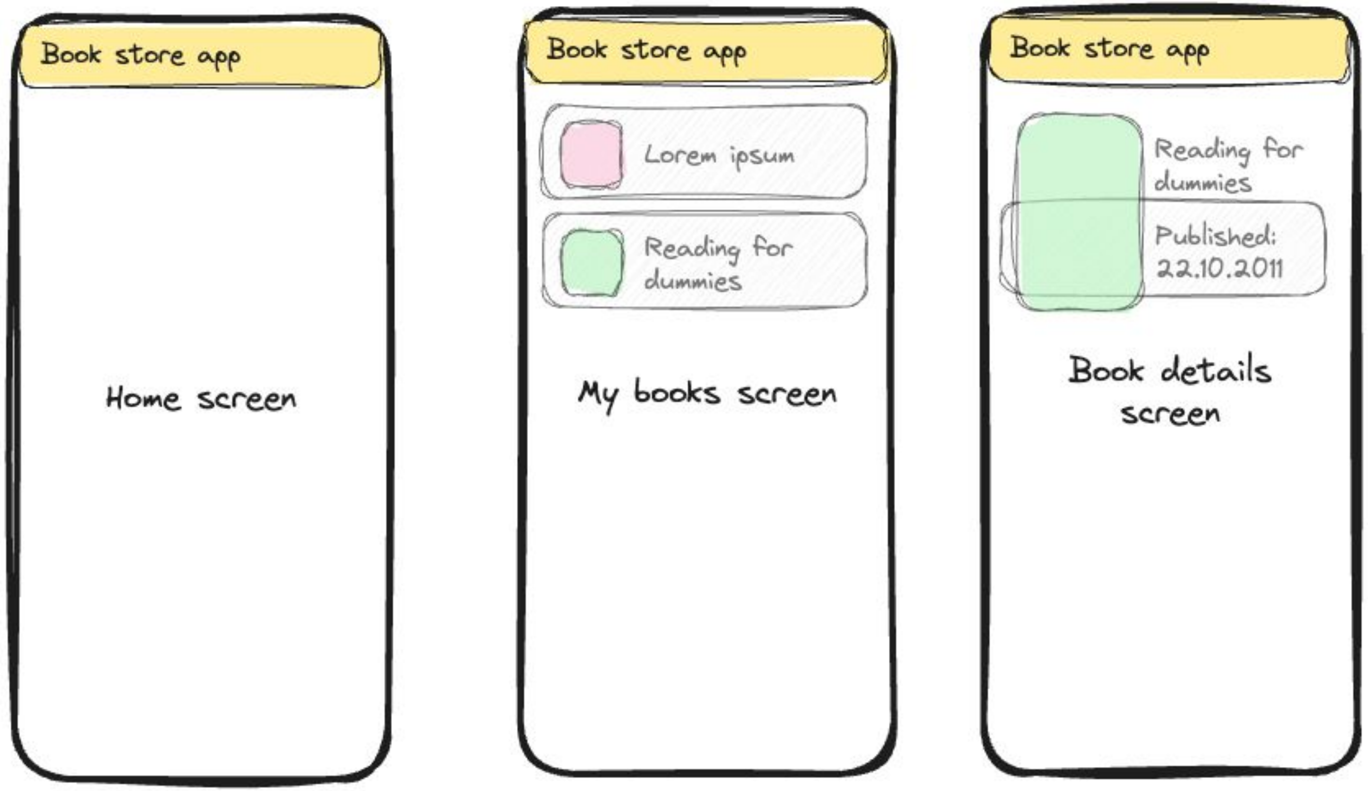
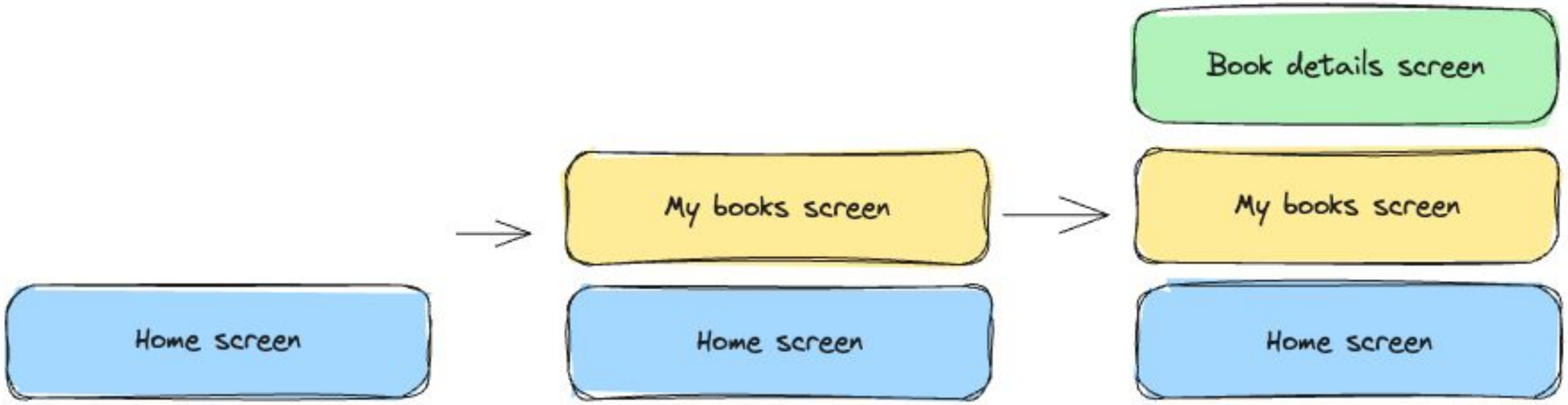
🗺️ Navigation

Navigation principles



Navigation principles

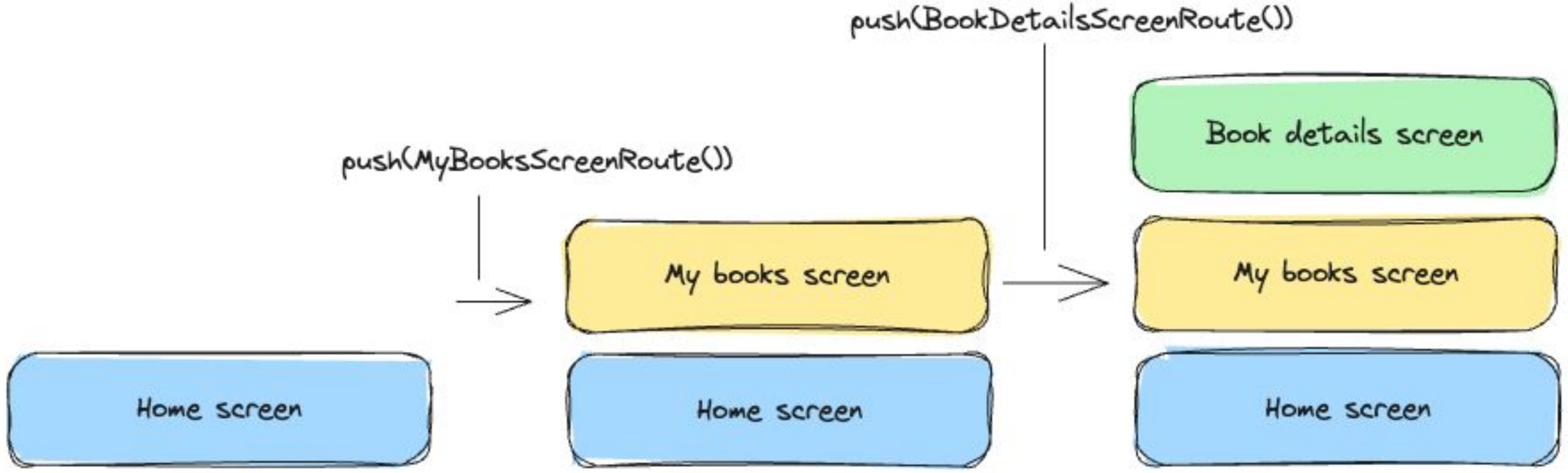
Screens stack on top of each other



Imperative vs declarative

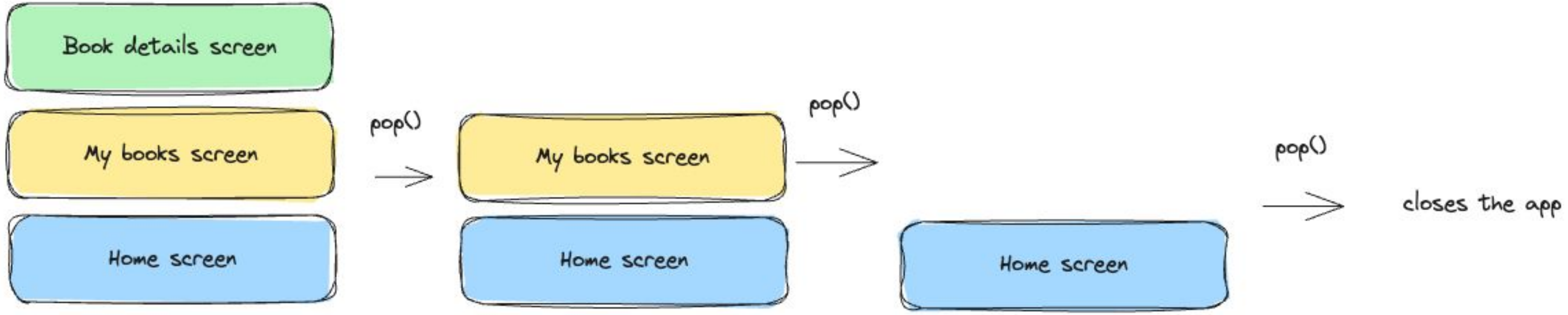
Imperative navigation

1. Start with a home screen
2. Push and pop screens as needed



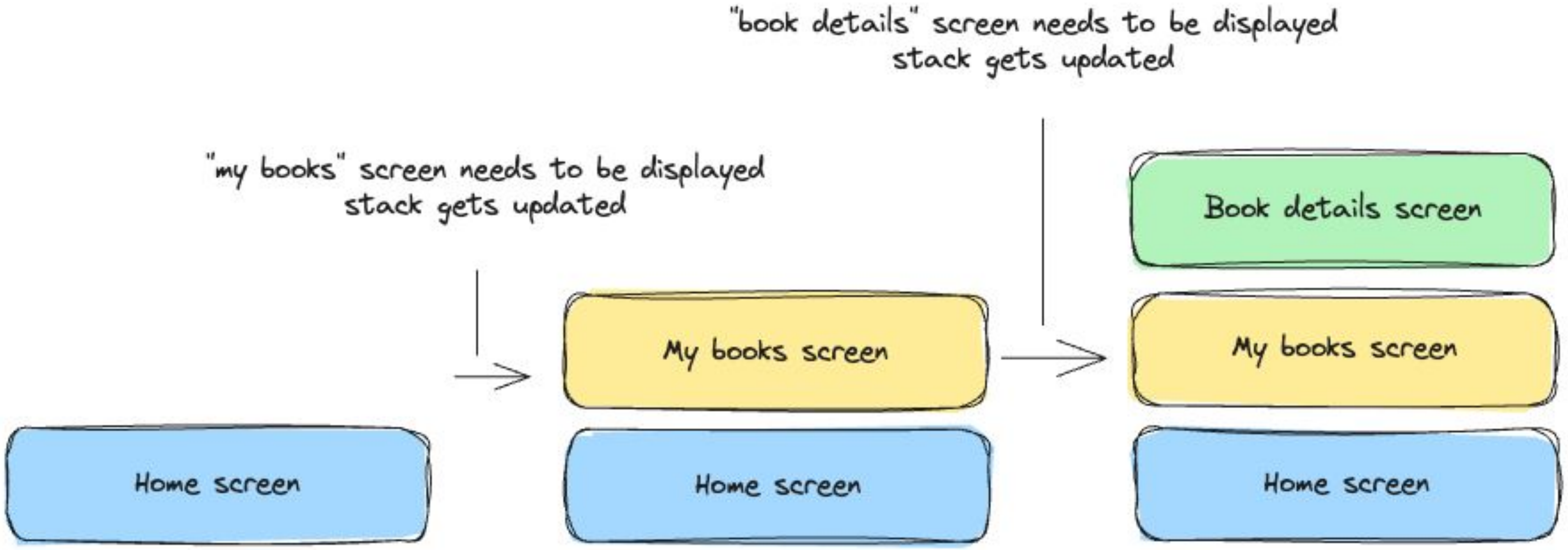
Imperative navigation

1. Start with a home screen
2. Push and pop screens as needed



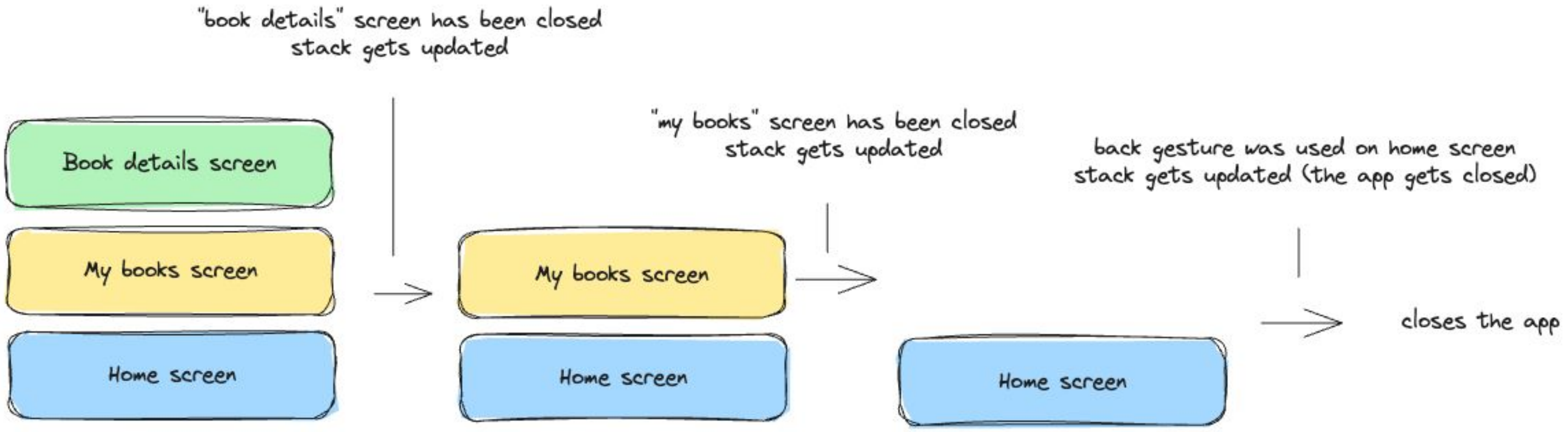
Declarative navigation

Decide the entire stack of screens whenever something changes



Declarative navigation

Decide the entire stack of screens whenever something changes


"book details" screen has been closed
stack gets updated
Book details screen
My books screen
Home screen
"my books" screen has been closed
stack gets updated
My books screen
Home screen
back gesture was used on home screen
stack gets updated (the app gets closed)
Home screen
closes the app

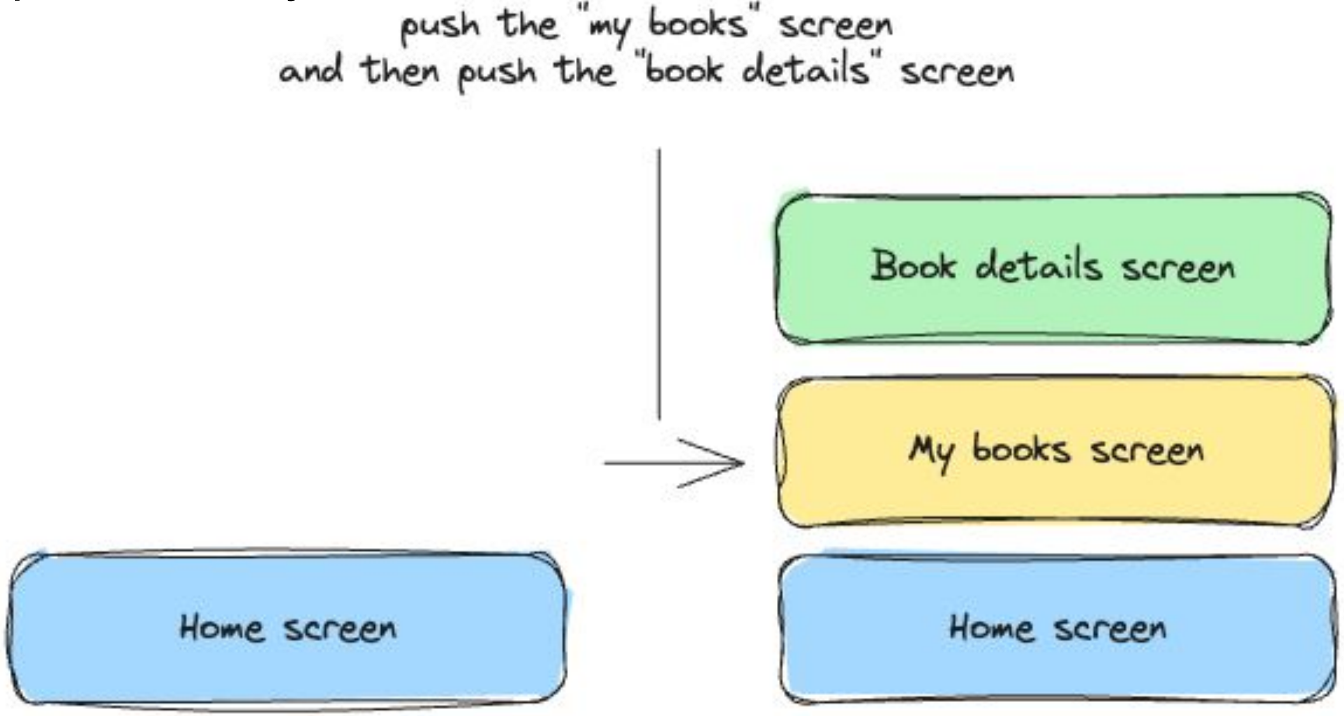
The difference

Imperative: “push this screen on top, now”

Declarative: “I need this screen to show up”

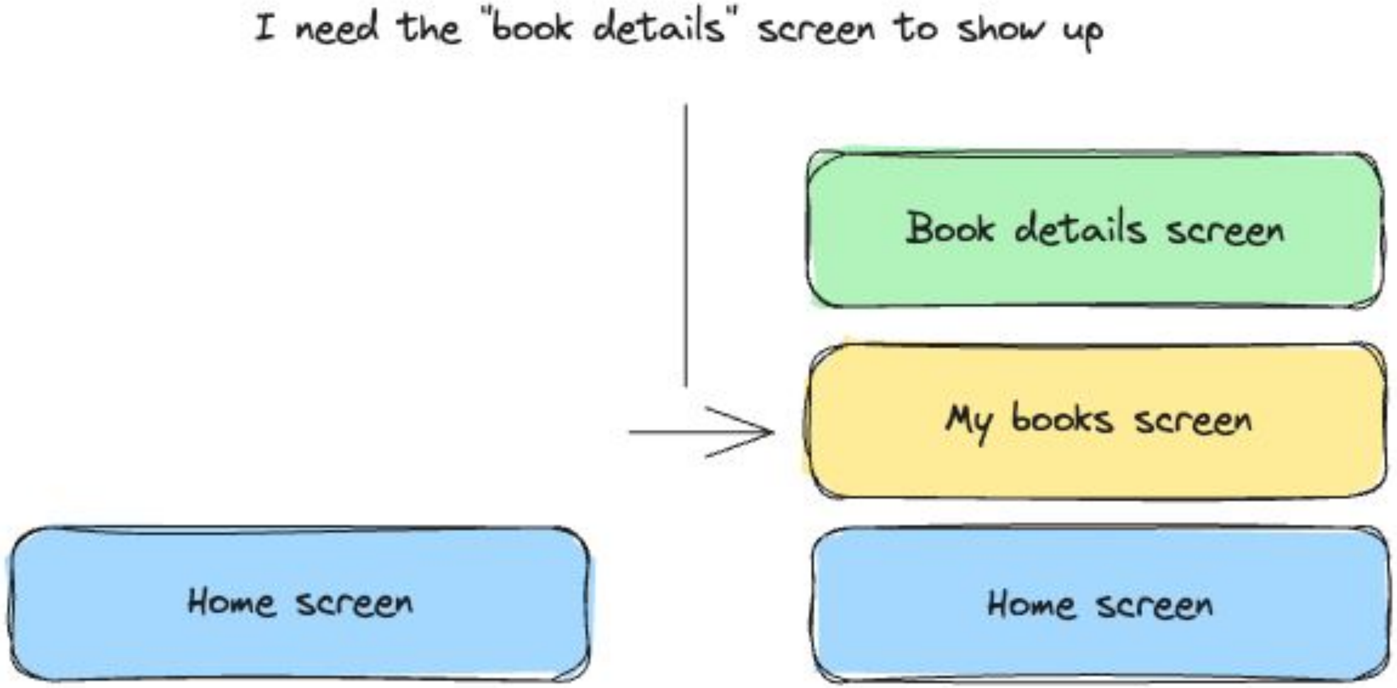
The difference

The imperative way


push the "my books" screen
and then push the "book details" screen
Home screen
Book details screen
My books screen
Home screen

The difference

The declarative way



Tradeoffs

Imperative navigation

- you have to specify each action
- widgets contain a lot of unneeded logic
- it’s very plug-and-play
- gets messy at scale
- there might (will) be issues when designing complex processes like auth, multi-screen forms

Declarative navigation

- you only say what you need
- widgets can be dumb(er)
- needs a lot of boilerplate
- easier to manage at scale
- good luck setting it up without prior experience

The navigation APIs

We build digital products.

LeanCode

Point of confusion

There are multiple navigation APIs:

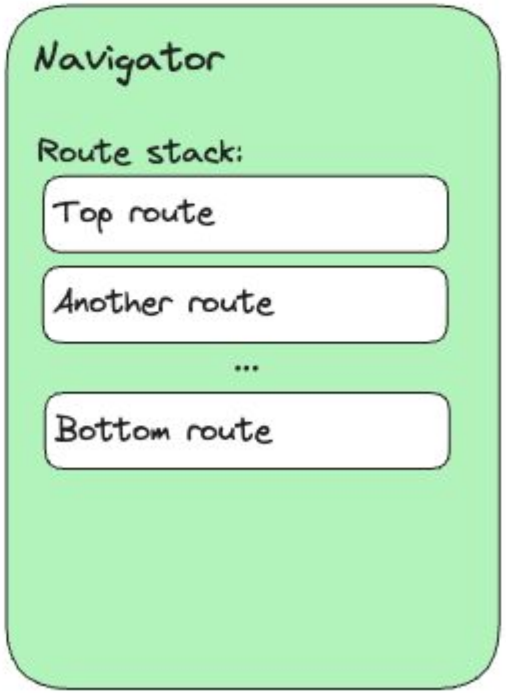
- Old imperative navigation
- “New” declarative navigation, Router 2.0
- go_router | Flutter Package (pub.dev) (formerly 3rd party package)
- More options available (e.g. auto_route | Flutter Package (pub.dev))

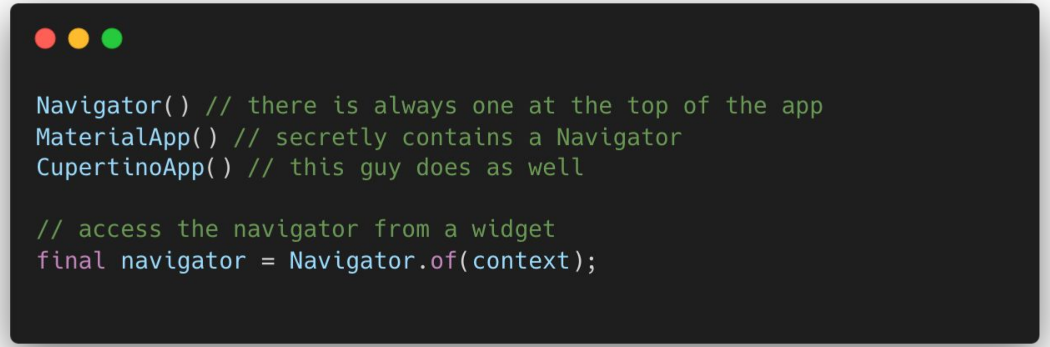
The builtins

Here’s a good in-depth article on the built in options if you’re interested

Learning Flutter’s new navigation and routing system | by John Ryan | Flutter | Medium

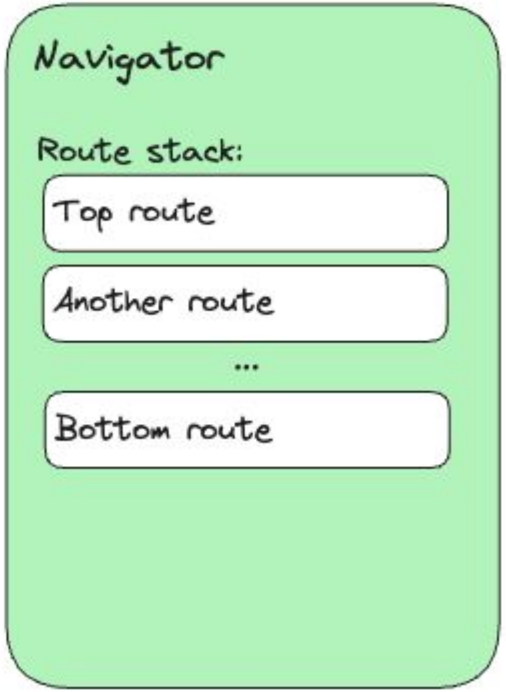
The Navigator

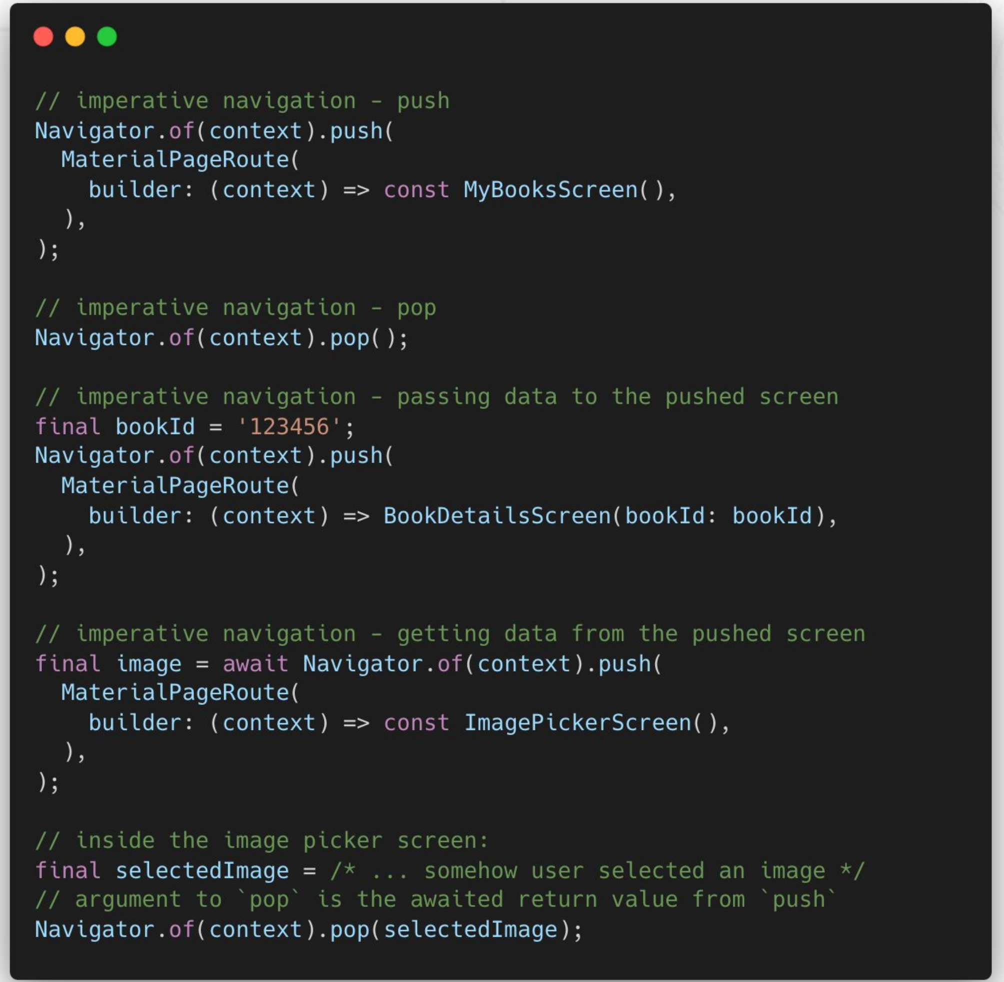




```
Navigator() // there is always one at the top of the app
MaterialApp() // secretly contains a Navigator
CupertinoApp() // this guy does as well

// access the navigator from a widget
final navigator = Navigator.of(context);
```

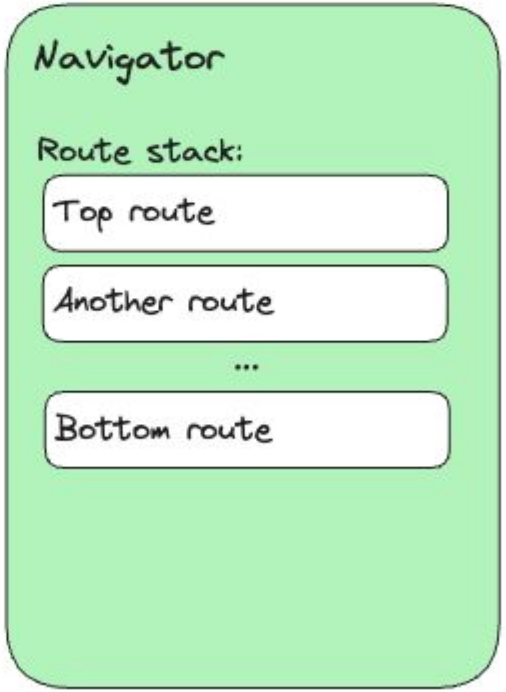
The Navigator

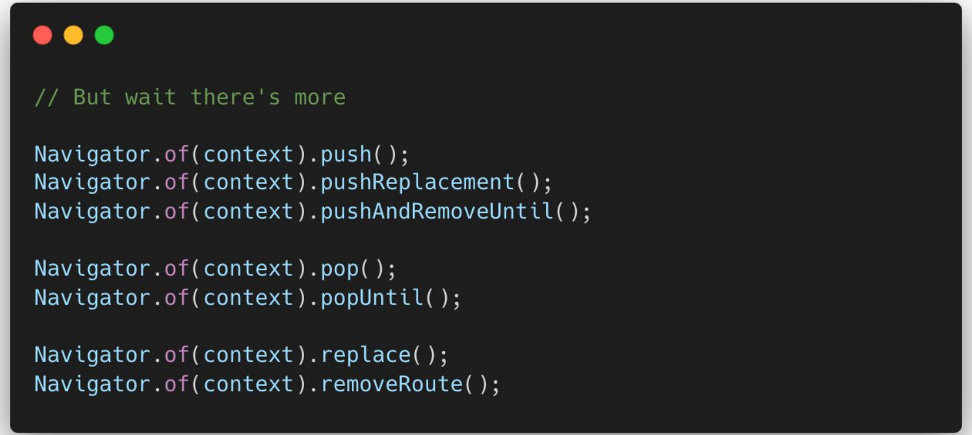




```dart
// imperative navigation - push
Navigator.of(context).push(
  MaterialPageRoute(
    builder: (context) => const MyBooksScreen(),
  ),
);

// imperative navigation - pop
Navigator.of(context).pop();

// imperative navigation - passing data to the pushed screen
final bookId = '123456';
Navigator.of(context).push(
  MaterialPageRoute(
    builder: (context) => BookDetailsScreen(bookId: bookId),
  ),
);

// imperative navigation - getting data from the pushed screen
final image = await Navigator.of(context).push(
  MaterialPageRoute(
    builder: (context) => const ImagePickerScreen(),
  ),
);

// inside the image picker screen:
final selectedImage = /* ... somehow user selected an image */
// argument to `pop` is the awaited return value from `push`
Navigator.of(context).pop(selectedImage);
```

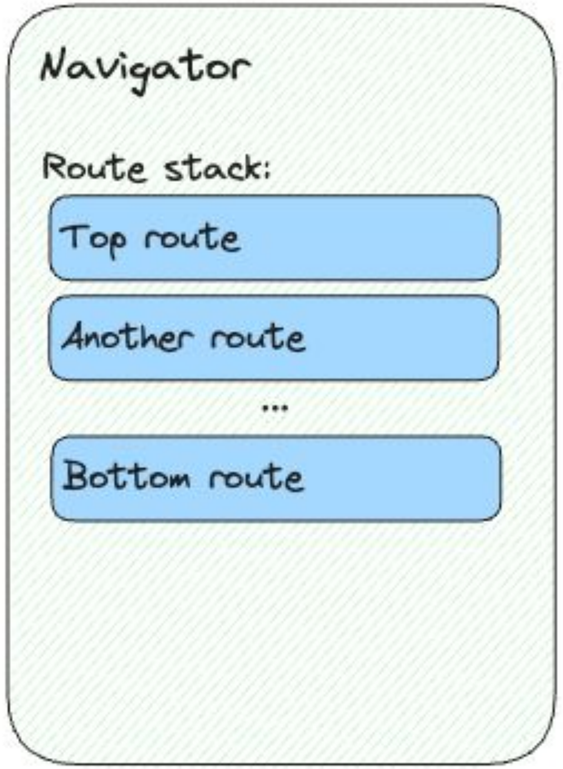
The Navigator





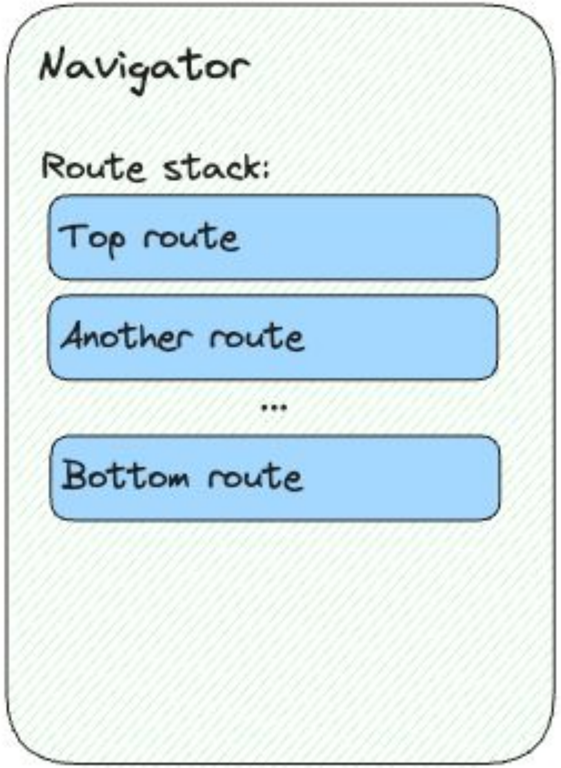
```
// But wait there's more

Navigator.of(context).push();
Navigator.of(context).pushReplacement();
Navigator.of(context).pushAndRemoveUntil();

Navigator.of(context).pop();
Navigator.of(context).popUntil();

Navigator.of(context).replace();
Navigator.of(context).removeRoute();
```

The Route



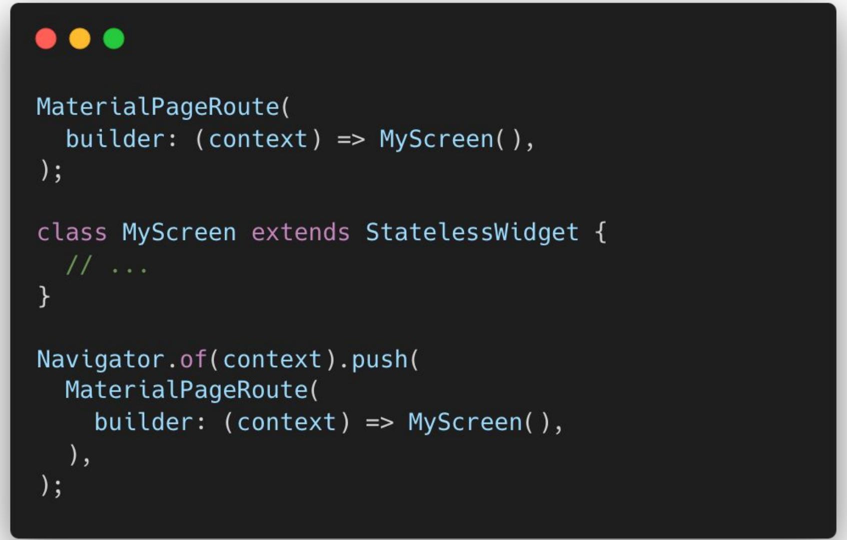
- is an entry on Navigator’s stack
- describes a screen, a popup, a drawer etc.
- knows how to display itself
- can have an animated transition
- is very abstracted out → use MaterialPageRoute

The Route



MaterialPageRoute:

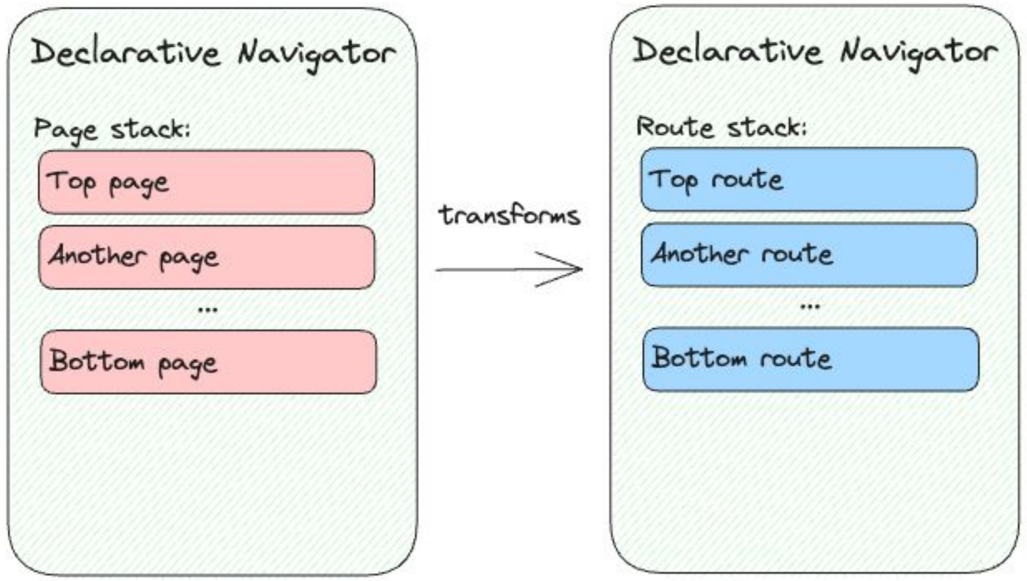
- has sensible defaults (material-based)
- only needs one parameter: widget to display (the builder param)



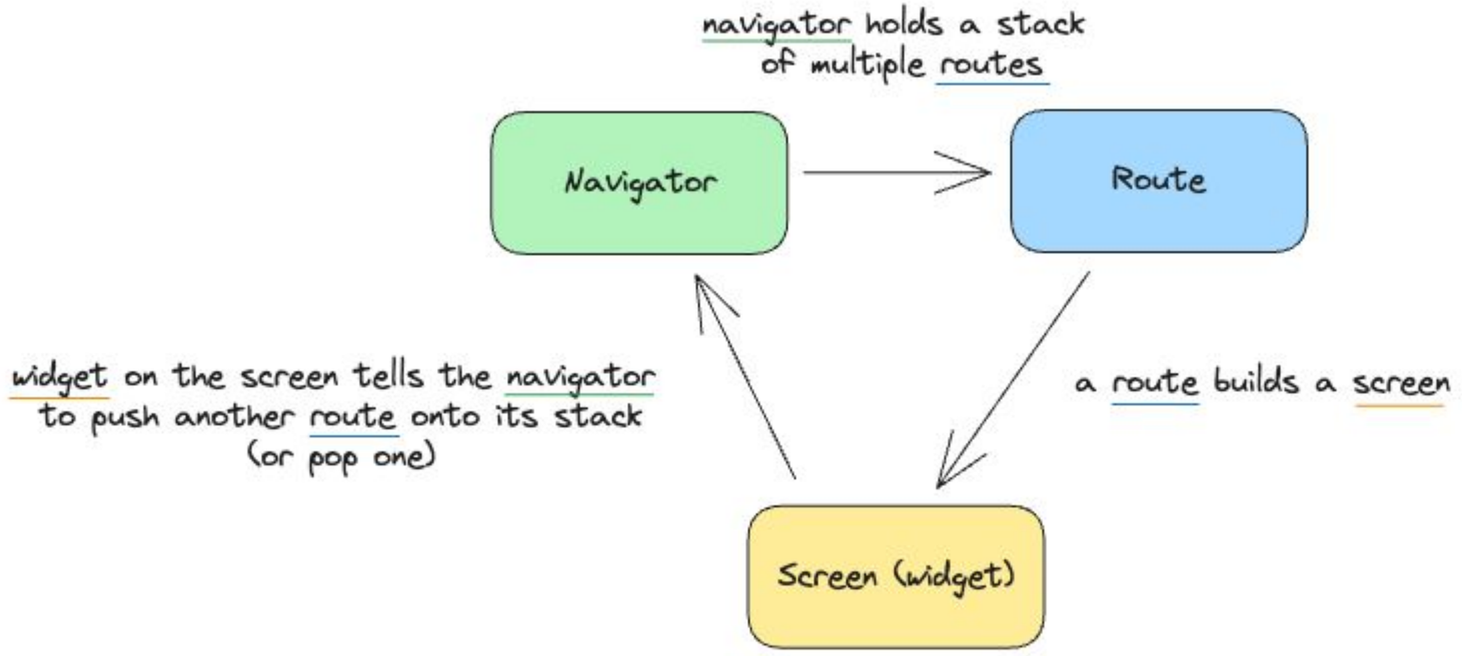
```
MaterialPageRoute(
  builder: (context) => MyScreen(),
);

class MyScreen extends StatelessWidget {
  // ...
}

Navigator.of(context).push(
  MaterialPageRoute(
    builder: (context) => MyScreen(),
  ),
);
```

The Page

Page – declarative Router 2.0 only. Don't bother unless using it.
Route had a builder for widgets, Page has a builder for routes



And how they fit together


navigator holds a stack of multiple routes
Navigator
Route
widget on the screen tells the navigator to push another route onto its stack (or pop one)
a route builds a screen
Screen (widget)

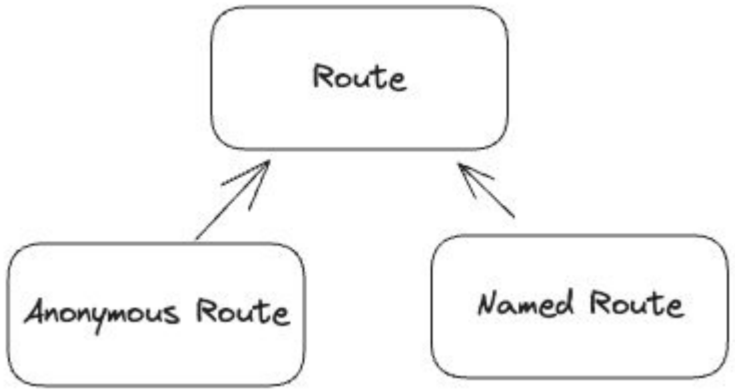
Declarative navigation

This is a complex and low-level subject.

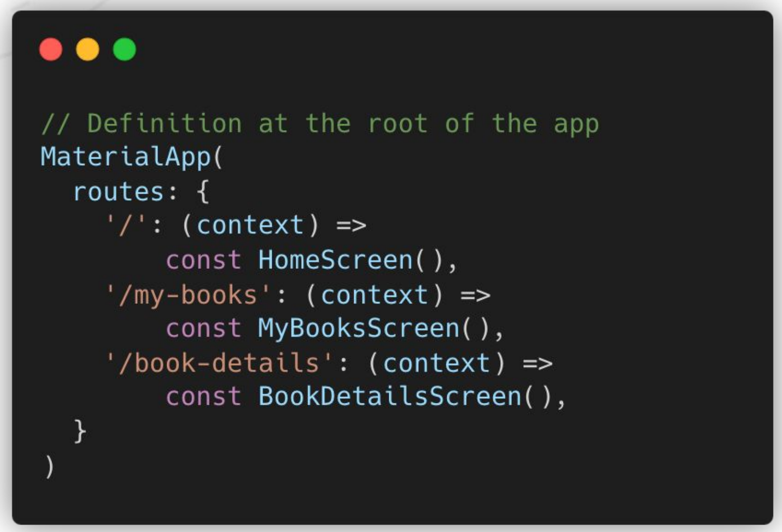
Let’s not go into that. Read the article if you’re interested.

[Learning Flutter’s new navigation and routing system | by John Ryan | Flutter | Medium]

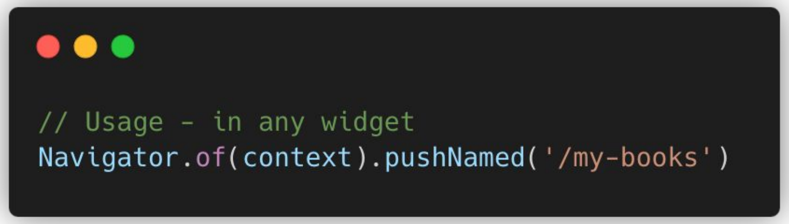
Route types



Named routes



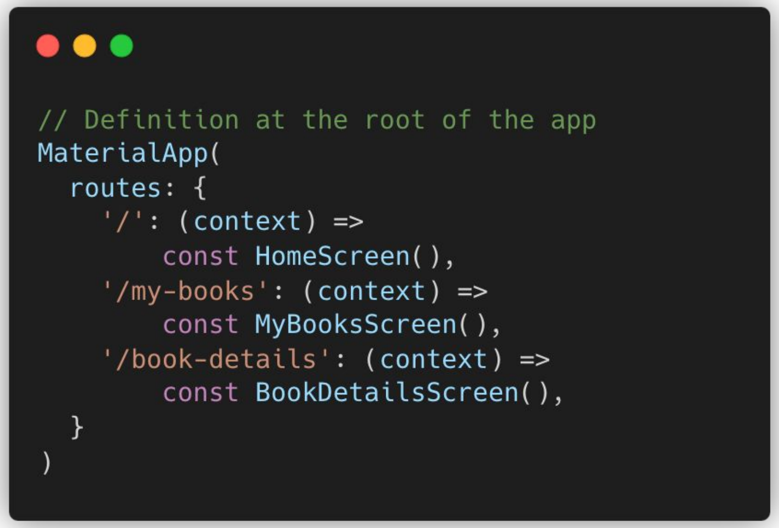
```
// Definition at the root of the app
MaterialApp(
  routes: {
    '/': (context) =>
        const HomeScreen(),
    '/my-books': (context) =>
        const MyBooksScreen(),
    '/book-details': (context) =>
        const BookDetailsScreen(),
  }
)
```



```
// Usage - in any widget
Navigator.of(context).pushNamed('/my-books')
```

Named routes

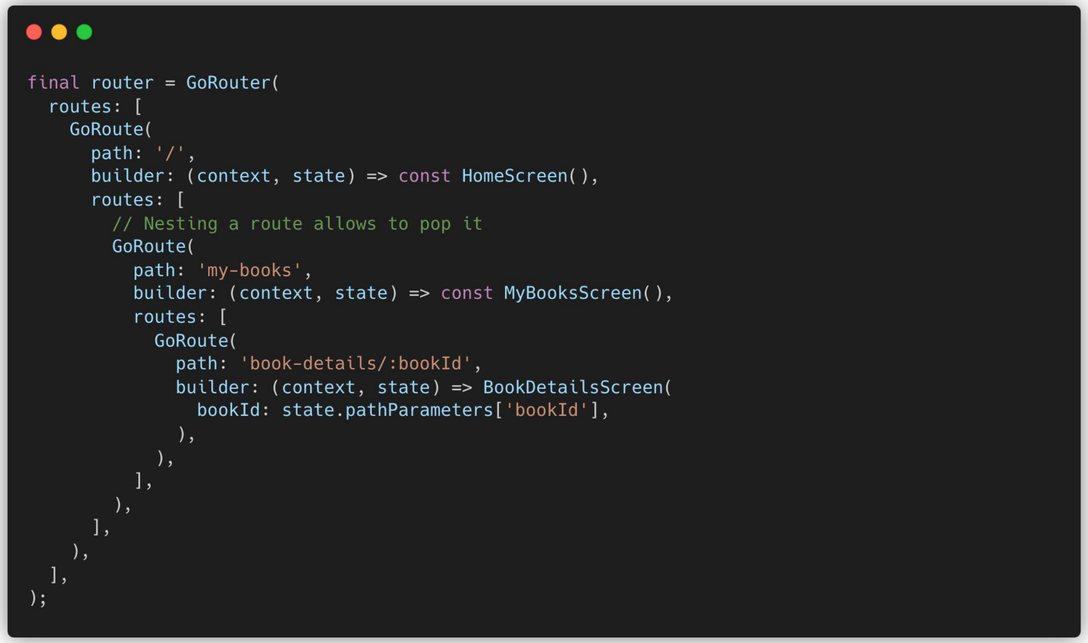
⚠️ caution: it’s cumbersome to read parameters when building named routes (e.g. the book details screen might need a book id to know which book to display)



```
// Definition at the root of the app
MaterialApp(
  routes: {
    '/': (context) =>
        const HomeScreen(),
    '/my-books': (context) =>
        const MyBooksScreen(),
    '/book-details': (context) =>
        const BookDetailsScreen(),
  }
)
```

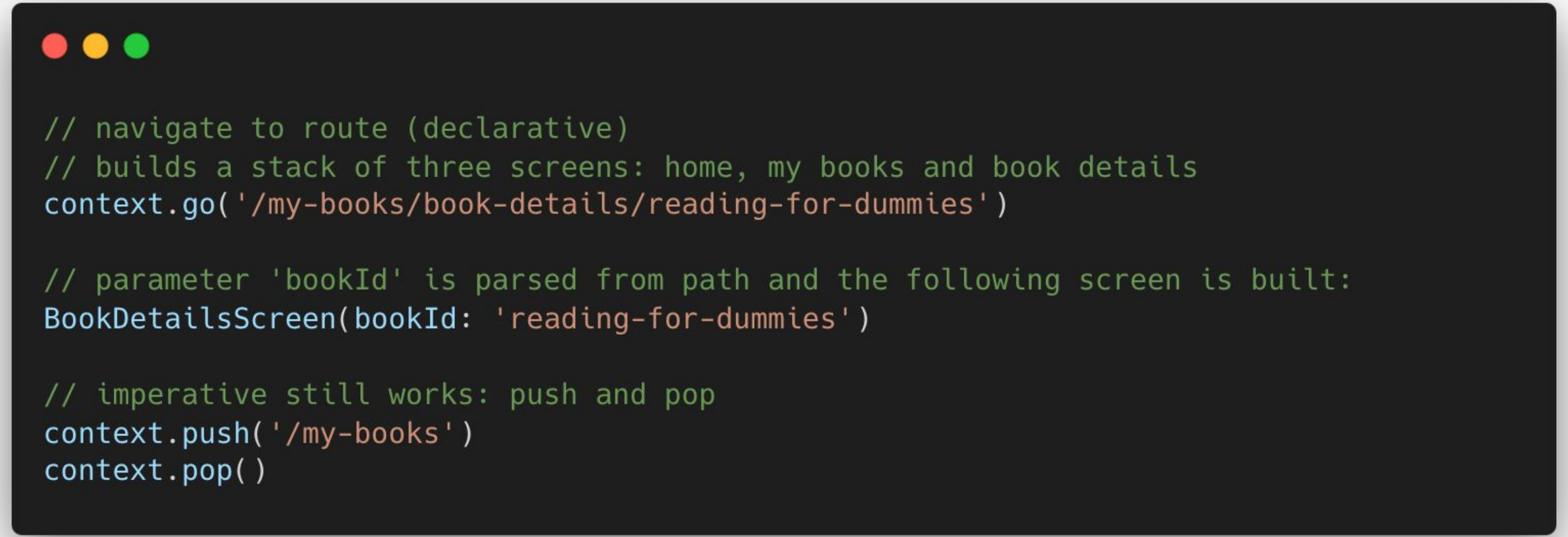
go_router (package 🔗)

- much more streamlined than using raw Navigator
- declare a hierarchy of routes at the top of the app



```
final router = GoRouter(
  routes: [
    GoRoute(
      path: '/',
      builder: (context, state) => const HomeScreen(),
      routes: [
        // Nesting a route allows to pop it
        GoRoute(
          path: 'my-books',
          builder: (context, state) => const MyBooksScreen(),
          routes: [
            GoRoute(
              path: 'book-details/:bookId',
              builder: (context, state) => BookDetailsScreen(
                bookId: state.pathParameters['bookId'],
              ),
            ),
          ],
        ),
      ],
    ),
  ],
);
```

go_router



```dart
// navigate to route (declarative)
// builds a stack of three screens: home, my books and book details
context.go('/my-books/book-details/reading-for-dummies')

// parameter 'bookId' is parsed from path and the following screen is built:
BookDetailsScreen(bookId: 'reading-for-dummies')

// imperative still works: push and pop
context.push('/my-books')
context.pop()
```

📦 Extras

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Discover more widgets

- Flutter Widget of the Week - YouTube
- Widget catalog | Flutter
- The documentation is rather expansive. Visit the API reference and readmes for in-depth explanations of specific concepts, e.g.
  - ListView class - widgets library - Dart API (flutter.dev)
  - Scrollable class - widgets library - Dart API (flutter.dev)
  - go_router | Flutter Package (pub.dev)
  - Flex class - widgets library - Dart API (flutter.dev)

Guide to flexbox

This is CSS but Flutter's flex model follows the CSS one quite closely.
This is a handy cheat sheet:

A Complete Guide to Flexbox | CSS-Tricks - CSS-Tricks