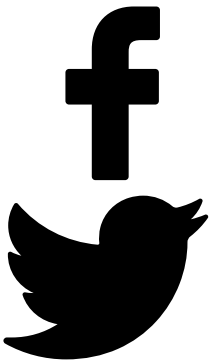
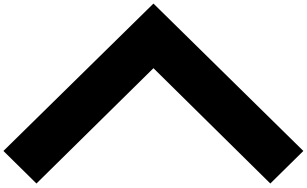
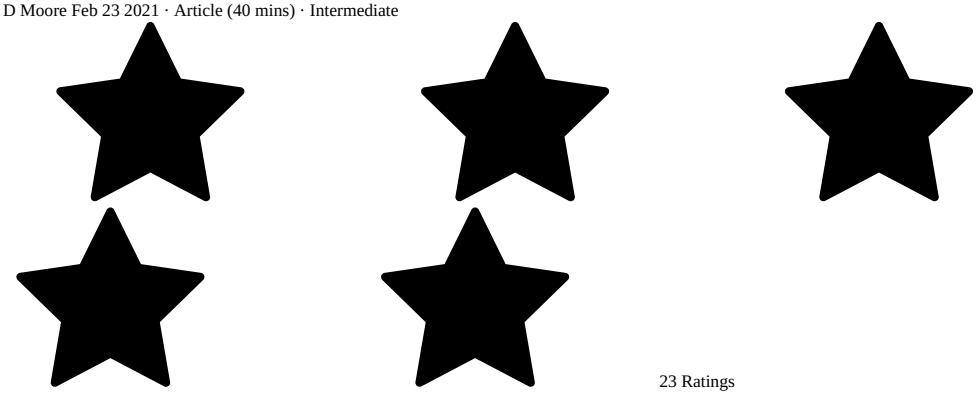




Flutter Navigator 2.0 and Deep Links

With Flutter’s Navigator 2.0, learn how to handle deep links in Flutter and gain the ultimate navigation control for your app.

By Kevin D Moore Feb 23 2021 · Article (40 mins) · Intermediate

3.9/5 

23 Ratings

Flutter’s first stable release was in December 2018, and it has grown rapidly since then. As is the case with any software, the developers who built it or use it are constantly refining it with each new version.

Initially, navigation between pages in Flutter was possible with *Navigator 1.0* only, which could `push` and `pop` pages. Most use cases required basic navigation that wasn’t a problem for Navigator 1.0. But with the introduction of more complex navigation use cases — especially after Flutter for Web came out — developers wanted the ability to add multiple pages in one go or remove any offscreen page(s) on the onscreen page. To cover these use cases, the Flutter team introduced *Navigator 2.0*.

Note: In Flutter, screens and pages are called routes. However, in this tutorial you will mostly see screens or pages, and routes a few times. They mean the same thing for the most part.

In this tutorial, you’ll learn how to use Navigator 2.0 by building pages of a shopping app brilliantly called, *Navigation App* :]. You’ll also learn how it can provide much more

granular control for your app's navigation and deep linking. To do so, you'll learn how to implement:

RouterDelegate
RouteInformationParser
BackButtonDispatcher

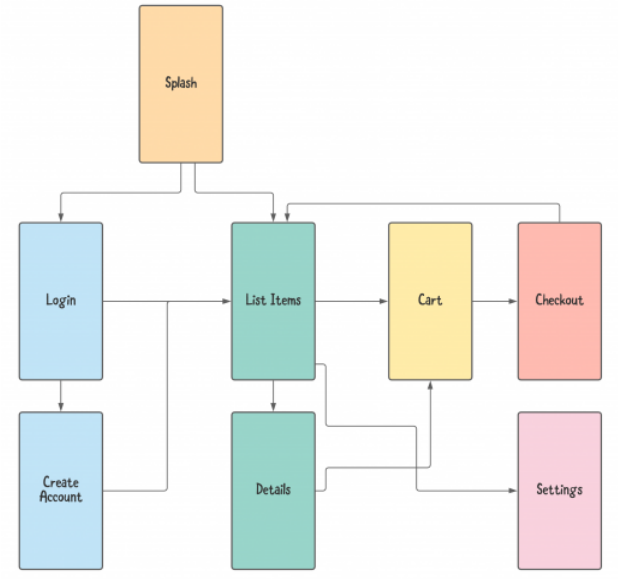
This tutorial uses Android Studio, but Visual Studio Code or IntelliJ IDEA will work fine as well.

Note: Navigator 2.0 is backward-compatible, and if needed, you can gradually introduce it to your existing apps that use Navigator 1.0 — without introducing any breaking changes.

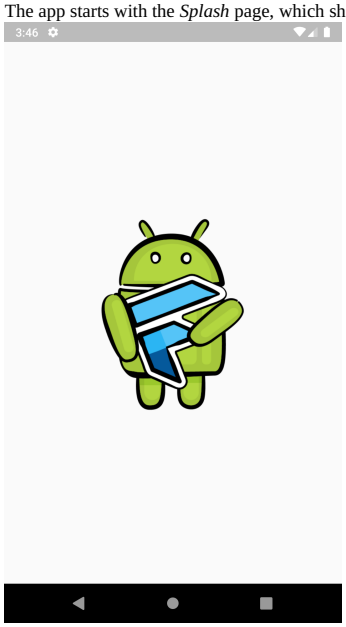
Getting Started

Download the starter project by clicking the *Download Materials* button at the top or bottom of the page.

The starter app is a set of screens for the shopping app. The UI doesn't do much, but it shows how to navigate between pages. This set of pages — represented as screens — is in the image below:



The app starts with the *Splash* page, which shows an image:



Run your app and verify it opens to this page. The app will stay on this page since the navigation system isn't yet implemented. Gradually, you'll add code to navigate between all screens.

Once you implement the navigation, the app should display the Splash page for a short duration and then show the Login page if the user isn't logged in. If they are, they'll see the Shopping List page instead. This logged-in state is saved as a `Boolean` value in the app's local storage using the shared_preferences package.

The user can go to the Create Account page for signing up or stay on the Login page, where they can log in and then navigate to the Shopping List page.

Note that this tutorial won't cover the implementation of a functional login system or any real-world shopping app features. The screens and their corresponding code mimic their UI to explain the navigation concept.

Navigator 1.0

Navigator 1.0 uses the `Navigator` and `Route` classes to navigate between pages. If you want to add, or `push`, a page, use:

```
Navigator.push(
  context,
  MaterialPageRoute(builder: (context) {
```

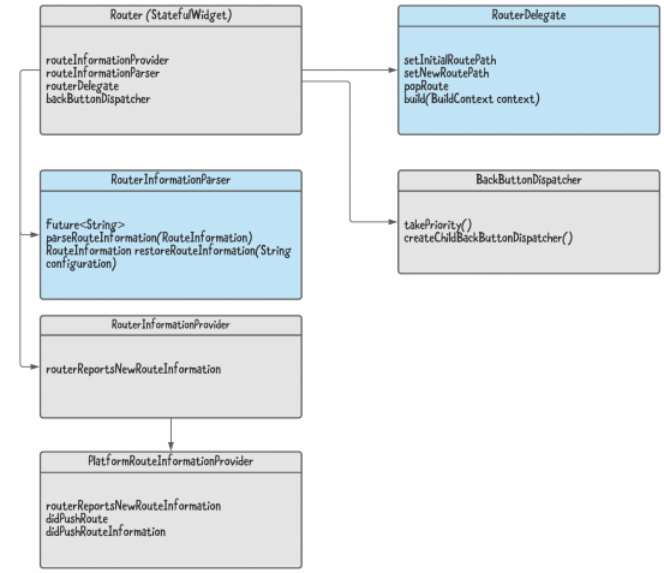
```
    return MyNewScreen();
  }),
);
```

Here, `MaterialPageRoute` returns an instance of your new screen, i.e. `MyNewScreen`.
To remove, or pop, the current page, use:
`Navigator.pop(context);`

These operations are straightforward, but things get interesting if you have a use case that requires recreating a set of pages, such as for *deep linking*.
In the context of mobile apps, deep linking consists of using a uniform resource identifier (URI) that links to a specific location within a mobile app rather than launching the app.
For example, while building an e-commerce app, you may want the user to go to a product page when they tap the "Product X is now on Sale!" notification. To handle this, the app needs to clear the current navigation stack of the app, add the home screen that displays products in a list and then add the product page to this stack of pages. With Navigator 1.0, this is difficult.
Luckily, Navigator 2.0 provides a lot more flexibility for such a use case.

Navigator 2.0

Unlike Navigator 1.0, which uses an imperative style of programming, Navigator 2.0 uses a declarative style. As a result, it feels more "Flutter-like". Understanding Navigator 2.0 involves understanding a few of its concepts such as:
Page: An abstract class that describes the configuration of a route
Router: A class that manages opening and closing pages of an application
RouteInformationParser: An abstract class used by the `Router`'s widget to parse route information into a configuration
RouteInformationProvider: An abstract class that provides route information for the `Router`'s widget
RouterDelegate: An abstract class used by the `Router`'s widget to build and configure a navigating widget
BackButtonDispatcher: Reports to a `Router` when the user taps the back button on platforms that support back buttons (such as Android)
TransitionDelegate: The delegate that decides how pages transition in or out of the screen when it's added or removed.
This article doesn't cover `TransitionDelegate`, as in most use cases, `DefaultTransitionDelegate` does a good job with transitions. If you need to handle transitions between pages in a unique way, you can create your own delegate by extending `TransitionDelegate`.
Here's a visual representation of the concepts mentioned above:



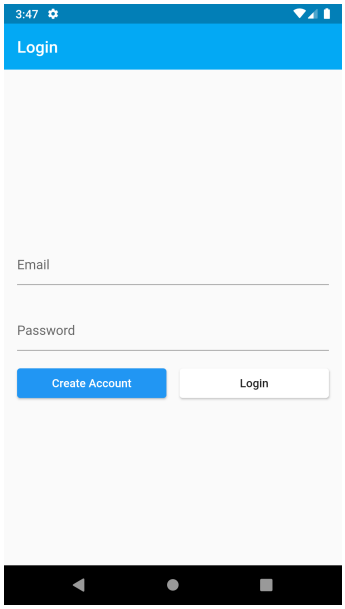
The classes in gray are optional to implement when using Navigator 2.0. However, the ones in blue, i.e. `RouteInformationParser` and `RouterDelegate`, must be implemented to use Navigator 2.0. You'll learn about both of these, and the optional `BackButtonDispatcher`, in the sections below.

Pages Overview

Before you begin to implement any navigation, the next sections will provide an overview of the pages in your starter app.

Login Page

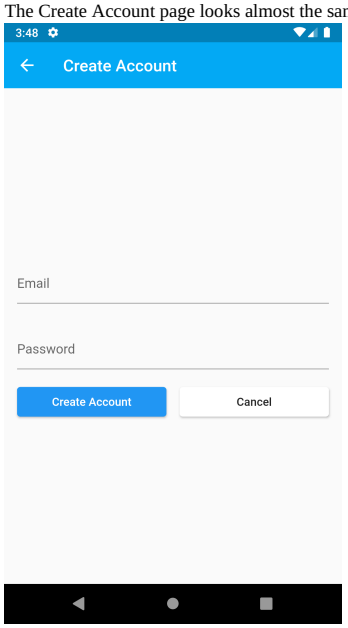
The Login page is the first page to appear after the Splash page if the user hasn't already logged in:



Clicking on the *Create Account* button takes the user to the *Create Account* page, and pressing the *Login* button takes the user to the *Shopping List* page. When pressing the *Login* button, set the `logged-in` flag using *Shared Preferences* to `true` so that the next time the user logs in, they go straight to the Shopping List page after the Splash page.

Create Account Page

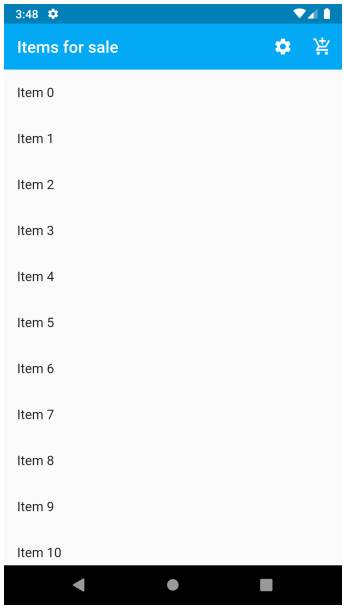
The Create Account page looks almost the same as the Login page:



The only difference here is the user can use the *Cancel* button, tap the back arrow icon or press the device back button to go back to the Login page.

Shopping List Page

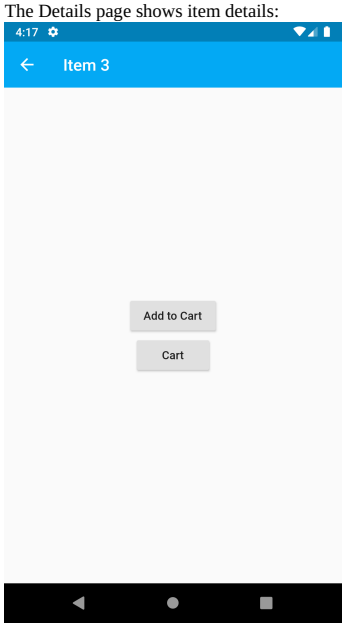
This page displays a list of items which is a hardcoded list of dummy data to simulate a shopping list:



When the user taps an item in this list, it takes them to the *Details* page. The item number clicked is passed to the Details page as a constructor argument. This page also supports two actions in the *AppBar*, which denote *Settings* and *Cart*. Tapping these will take the user to the respective pages.

Details Page

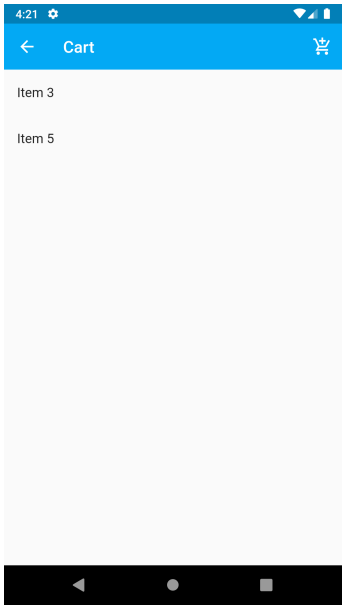
The Details page shows item details:



This screen shows the buttons *Add to Cart* and *Cart*. The *Add to Cart* button will add the item to an internal list that mimics a cart, and will take the user back to the Shopping List page. The *Cart* button will take the user to the *Cart* page.

Cart Page

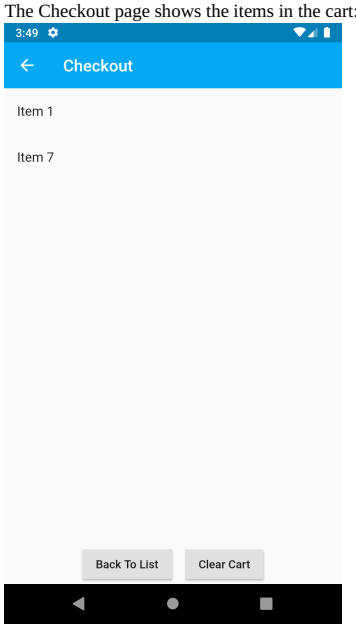
This page shows the items in the cart:



It has an *AppBar* action for navigating to the *Checkout* page.

Checkout Page

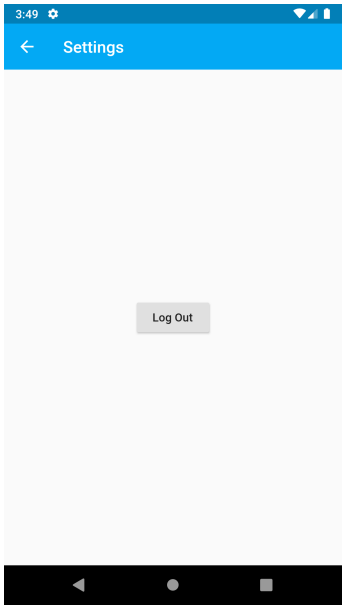
The Checkout page shows the items in the cart:



It has two buttons: one to go back to the Shopping List page, and another to clear the cart.

Settings Page

This page allows the user to log out:



Afterward, they'll return to the Login page. This will also reset the `logged-in` flag to `false` to preserve this state.

Pages Setup

Now that you're aware of all the pages the app displays, you'll need some information about the pages to represent them in the app. This information shall be captured in a class named `PageConfiguration`.

In the router directory, open up the Dart file named *ui_pages.dart*. Here you have some constants for the different paths:

```
const String SplashPath = '/splash';
const String LoginPath = '/login';
const String CreateAccountPath = '/createAccount';
const String ListItemsPath = '/listItems';
const String DetailsPath = '/details';
const String CartPath = '/cart';
const String CheckoutPath = '/checkout';
const String SettingsPath = '/settings';
```

The constants above define the paths or routes of each screen. It's important to represent the UI for each page. This is done with an `enum`:

```
enum Pages {
  Splash,
  Login,
  CreateAccount,
  List,
  Details,
  Cart,
  Checkout,
  Settings
}
```

Finally, the `PageConfiguration` class mentioned earlier combines all the information about each page you defined above:

```
class PageConfiguration {
  final String key;
  final String path;
  final Pages uiPage;
  PageAction currentPageAction;


 PageConfiguration(
      {@required this.key, @required this.path, @required this.uiPage, this.currentPageAction});
}
```

`PageConfiguration` holds two *String*s, which represent the page's `key` and `path`. And then a third parameter which represents the UI associated with that page using the `Pages` enum you added earlier. The fourth item remembers the current page action that was used for this page.

Next is the `PageConfigurations` constants to hold information about each of the pages of the app, as shown below.

```
PageConfiguration SplashPageConfig =
    PageConfiguration(key: 'Splash', path: SplashPath, uiPage: Pages.Splash, currentPageAction: null);
PageConfiguration LoginPageConfig =
    PageConfiguration(key: 'Login', path: LoginPath, uiPage: Pages.Login, currentPageAction: null);
PageConfiguration CreateAccountPageConfig = PageConfiguration(
    key: 'CreateAccount', path: CreateAccountPath, uiPage: Pages.CreateAccount, currentPageAction: null);
PageConfiguration ListItemsPageConfig = PageConfiguration(
    key: 'ListItems', path: ListItemsPath, uiPage: Pages.List);
PageConfiguration DetailsPageConfig =
    PageConfiguration(key: 'Details', path: DetailsPath, uiPage: Pages.Details, currentPageAction: null);
```

```
PageConfiguration CartPageConfig =
    PageConfiguration(key: 'Cart', path: CartPath, uiPage: Pages.Cart, currentPageAction: null);
PageConfiguration CheckoutPageConfig = PageConfiguration(
    key: 'Checkout', path: CheckoutPath, uiPage: Pages.Checkout, currentPageAction: null);
PageConfiguration SettingsPageConfig = PageConfiguration(
    key: 'Settings', path: SettingsPath, uiPage: Pages.Settings, currentPageAction: null);
```

For the Splash page, a constant named `SplashPageConfig` represents the page's `PageConfiguration`. The first parameter of `PageConfiguration` represents the key `'Splash'`. The second argument represents the Splash page's path, `SplashPath`. Finally, the third argument represents the UI associated with the Splash page, i.e. `Pages.Splash`.
The same is done for the other pages.

AppState

Every app needs to keep track of what state it is in. Is the user logged in? Does the user have any items in their cart? What page are they on? All of this information is stored in the AppState class. Open up *app_state.dart* in the *lib* directory. The first item is an enum for the page:

```
enum PageState {
  none,
  addPage,
  addAll,
  addWidget,
  pop,
  replace,
  replaceAll
}
```

This defines what types of page states the app can be in. If the app is in the `none` state, nothing needs to be done. If it is in the `addPage` state, then a page needs to be added. To pop a page, set the page state to `pop`.
Next is the page action:

```
class PageAction {
  PageState state;
  PageConfiguration page;
  List<PageConfiguration> pages;
  Widget widget;

  PageAction({this.state = PageState.none, this.page = null, this.pages = null, this.widget = null});
}
```

This wraps several items that allow the router to handle a page action. If the state is `addPage`, the page field will have the new page to add. The page, pages and widget are all optional fields and each are used differently depending on the page state.
The last class is AppState. This class holds the logged-in flag, shopping cart items and current page action. Look over the other fields and methods.

```
class AppState extends ChangeNotifier {
  bool _loggedIn = false;
  bool get loggedIn  => _loggedIn;
  bool _splashFinished = false;
  bool get splashFinished => _splashFinished;
  final cartItems = [];
  String emailAddress;
  String password;
  PageAction _currentAction = PageAction();
  PageAction get currentAction => _currentAction;
  set currentAction(PageAction action) {
    _currentAction = action;
    notifyListeners();
  }

  AppState() {
    getLoggedInState();
  }

  void resetCurrentAction() {
    _currentAction = PageAction();
  }

  void addToCart(String item) {
    cartItems.add(item);
    notifyListeners();
  }

  void removeFromCart(String item) {
    cartItems.add(item);
    notifyListeners();
  }

  void clearCart() {
    cartItems.clear();
    notifyListeners();
  }
```

```
  void setSplashFinished() {
    _splashFinished = true;
    if (_loggedIn) {
      _currentAction = PageAction(state: PageState.replaceAll, page: ListItemsPageConfig);
    } else {
      _currentAction = PageAction(state: PageState.replaceAll, page: LoginPageConfig);
    }
    notifyListeners();
  }

  void login() {
    _loggedIn = true;
    saveLoginState(loggedIn);
    _currentAction = PageAction(state: PageState.replaceAll, page: ListItemsPageConfig);
    notifyListeners();
  }

  void logout() {
    _loggedIn = false;
    saveLoginState(loggedIn);
    _currentAction = PageAction(state: PageState.replaceAll, page: LoginPageConfig);
    notifyListeners();
  }

  void saveLoginState(bool loggedIn) async {
    final prefs = await SharedPreferences.getInstance();
    prefs.setBool(LoggedInKey, loggedIn);
  }

  void getLoggedInState() async {
    final prefs = await SharedPreferences.getInstance();
    _loggedIn = prefs.getBool(LoggedInKey);
    if (_loggedIn == null) {
      _loggedIn = false;
    }
  }
}
```

RouterDelegate

RouterDelegate contains the core logic for Navigator 2.0. This includes controlling the navigation between pages. This class is an abstract class that requires classes that extend `RouterDelegate` to implement all of its unimplemented methods.

Begin by creating a new Dart file in the *router* directory called *router_delegate.dart*. You will name the `RouterDelegate` for this app `ShoppingRouterDelegate`. Add the following *import* statements:

```
import 'package:flutter/cupertino.dart';
import 'package:flutter/foundation.dart';
import 'package:flutter/material.dart';
import '../app_state.dart';
import '../ui/details.dart';
import '../ui/cart.dart';
import '../ui/checkout.dart';
import '../ui/create_account.dart';
import '../ui/list_items.dart';
import '../ui/login.dart';
import '../ui/settings.dart';
import '../ui/splash.dart';
import 'ui_pages.dart';
```

This includes imports for all the UI pages. Next, add the code representing the basic structure of this app's `RouterDelegate`, i.e. `ShoppingRouterDelegate`:

```
// 1
class ShoppingRouterDelegate extends RouterDelegate<PageConfiguration>
    // 2
    with ChangeNotifier, PopNavigatorRouterDelegateMixin<PageConfiguration> {

  // 3
  final List<Page> _pages = [];

  // 4
  @override
  final GlobalKey<NavigatorState> navigatorKey;

  // 5
  final AppState appState;

  // 6
  ShoppingRouterDelegate(this.appState) : navigatorKey = GlobalKey() {
    appState.addListener(() {
      notifyListeners();
    });
```

```
  }

  // 7
  /// Getter for a list that cannot be changed
  List<MaterialPage> get pages => List.unmodifiable(_pages);
  /// Number of pages function
  int numPages() => _pages.length;

// 8
  @override
  PageConfiguration get currentConfiguration =>
      _pages.last.arguments as PageConfiguration;
}
```

Ignore the errors for now, you will resolve them soon. Here's what's happening in the code above:

. This represents the app's `RouterDelegate`, `ShoppingRouterDelegate`. It extends the abstract `RouterDelegate`, which produces a configuration for each `Route`. This configuration is `PageConfiguration`.

. `ShoppingRouterDelegate` uses the `ChangeNotifier` mixin, which helps notify any listeners of this delegate to update themselves whenever `notifyListeners()` is invoked. This class also uses `PopNavigatorRouterDelegateMixin`, which lets you remove pages. It'll also be useful later when you implement `BackButtonDispatcher`.

. This list of `Pages` is the core of the app's navigation, and it denotes the current list of pages in the navigation stack. It's private so that it can't be modified directly, as that could lead to errors and unwanted states. You'll see later how to handle modifying the navigation stack without writing to this list directly from anywhere outside `ShoppingRouterDelegate`.

. `PopNavigatorRouterDelegateMixin` requires a `navigatorKey` used for retrieving the current navigator of the `Router`.

. Declare a final `AppState`variable.

. Define the constructor. This constructor takes in the current app state and creates a global navigator key. It's important that you only create this key once.

. Define public getter functions.

. `currentConfiguration` gets called by `Router` when it detects route information may have changed. "current" means the topmost page of the app i.e. `_pages.last`. This getter returns configuration of type `PageConfiguration` as defined on line 1 while creating `RouterDelegate<PageConfiguration>`. The `currentConfiguration` for this `last` page can be accessed as `_pages.last.arguments`.

Next, you'll implement *build*.

Implementing build

One of the methods from `RouterDelegate` that you'll implement is `build`. It gets called by `RouterDelegate` to obtain the widget tree that represents the current state. In this scenario, the current state is the navigation history of the app. As such, use `Navigator` to implement `build` by adding the code below:

```
@override
Widget build(BuildContext context) {
  return Navigator(
    key: navigatorKey,
    onPopPage: _onPopPage,
    pages: buildPages(),
  );
}
```

`Navigator` uses the previously defined `navigatorKey` as its *key*. `Navigator` needs to know what to do when the app requests the removal or popping of a page via a back button press and calls `_onPopPage`.

pages calls `buildPages` to return the current list of pages, which represents the app's navigation stack.

Removing Pages

To remove pages, define a private `_onPopPage` method:

```
bool _onPopPage(Route<dynamic> route, result) {
  // 1
  final didPop = route.didPop(result);
  if (!didPop) {
    return false;
  }
  // 2
  if (canPop()) {
    pop();
    return true;
  } else {
    return false;
  }
}
```

This method will be called when `pop` is invoked, but the current *Route* corresponds to a *Page* found in the `pages` list.

The `result` argument is the value with which the route completed. An example of this is the value returned from a dialog when it's popped.

In the code above:

. There's a request to pop the route. If the route can't handle it internally, it returns `false`.

. Otherwise, check to see if we can remove the top page and remove the page from the list of pages.

Note that `route.settings` extends `RouteSettings`.

It's possible you'll want to remove a page from the navigation stack. To do this, create a private method `_removePage`. This modifies the internal `_pages` field:

```
void _removePage(MaterialPage page) {
  if (page != null) {
```

```
    _pages.remove(page);
  }
}
```

`_removePage` is a private method, so to access it from anywhere in the app, use *RouterDelegate*'s `popRoute` method. Now add pop methods:

```
void pop() {
  if (canPop()) {
    _removePage(_pages.last);
  }
}

bool canPop() {
  return _pages.length > 1;
}

@override
Future<bool> popRoute() {
  if (canPop()) {
    _removePage(_pages.last);
    return Future.value(true);
  }
  return Future.value(false);
}
```

These methods ensure there are at least two pages in the list. Both `pop` and `popRoute` will call `_removePage` to remove a page and return `true` if it can pop, ottherwise, return `false` to close the app. If you didn't add the check here and called `_removePage` on the last page of the app, you would see a blank screen.

Creating and Adding a Page

Now that you know how to remove a page, you'll write code to create and add a page. You'll use *MaterialPage*, which is a `Page` subclass provided by the Flutter SDK:

```
MaterialPage _createPage(Widget child, PageConfiguration pageConfig) {
  return MaterialPage(
      child: child,
      key: Key(pageConfig.key),
      name: pageConfig.path,
      arguments: pageConfig
  );
}
```

The first argument for this method is a *Widget*. This widget will be the UI displayed to the user when they're on this page. The second argument is an object of type `PageConfiguration`, which holds the configuration of the page this method creates.

The first three parameters of `MaterialPage` are straightforward. The fourth parameter is `arguments`, and the `pageConfig` is passed to it. This lets you easily access the configuration of the page if needed.

Now that there's a method to create a page, create another method to add this page to the navigation stack, i.e. to the `_pages` list:

```
void _addPageData(Widget child, PageConfiguration pageConfig) {
  _pages.add(
    _createPage(child, pageConfig),
  );
}
```

The public method for adding a page is `addPage`. You'll implement it using the `Pages` enum:

```
void addPage(PageConfiguration pageConfig) {
  // 1
  final shouldAddPage = _pages.isEmpty ||
        (_pages.last.arguments as PageConfiguration).uiPage !=
            pageConfig.uiPage;

  if (shouldAddPage) {
    // 2
    switch (pageConfig.uiPage) {
      case Pages.Splash:
        // 3
        _addPageData(Splash(), SplashPageConfig);
        break;
      case Pages.Login:
        _addPageData(Login(), LoginPageConfig);
        break;
      case Pages.CreateAccount:
        _addPageData(CreateAccount(), CreateAccountPageConfig);
        break;
      case Pages.List:
        _addPageData(ListItems(), ListItemsPageConfig);
        break;
      case Pages.Cart:
        _addPageData(Cart(), CartPageConfig);
        break;
      case Pages.Checkout:
        _addPageData(Checkout(), CheckoutPageConfig);
        break;
```

```
      case Pages.Settings:
        _addPageData(Settings(), SettingsPageConfig);
        break;
      case Pages.Details:
        if (pageConfig.currentPageAction != null) {
          _addPageData(pageConfig.currentPageAction.widget, pageConfig);
        }
        break;
      default:
        break;
    }
  }
}
```

The code above does the following:

. Decides whether to add a new page. The second condition ensures the same page isn't added twice by mistake. Example: You wouldn't want to add a Login page immediately on top of another Login page.

. Uses a `switch` case on the `pageConfig`'s `UI_PAGE` so you know which page to add.

. Uses the recently created private `addPageData` to add the widget and `PageConfiguration` associated with the corresponding `UI_PAGE` from the `switch` case. You'll notice `switch` doesn't handle the Details page case. That's because adding that page requires another argument, which you'll read about later.

Modifying the Contents

Now comes the fun part. Create some methods that allow you to modify the contents of the `_pages` list. To cover all use cases of the app, you'll need methods to add, delete and replace the `_pages` list:

```
// 1
void replace(PageConfiguration newRoute) {
  if (_pages.isNotEmpty) {
    _pages.removeLast();
  }
  addPage(newRoute);
}

// 2
void setPath(List<MaterialPage> path) {
  _pages.clear();
  _pages.addAll(path);
}

// 3
void replaceAll(PageConfiguration newRoute) {
  setNewRoutePath(newRoute);
}

// 4
void push(PageConfiguration newRoute) {
  addPage(newRoute);
}

// 5
void pushWidget(Widget child, PageConfiguration newRoute) {
  _addPageData(child, newRoute);
}

// 6
void addAll(List<PageConfiguration> routes) {
  _pages.clear();
  routes.forEach((route) {
    addPage(route);
  });
}
```

Here's a breakdown of the code above:

. `replace` method: Removes the last page, i.e the top-most page of the app, and replaces it with the new page using the add method

. `setPath` method: Clears the entire navigation stack, i.e. the `_pages` list, and adds all the new pages provided as the argument

. `replaceAll` method: Calls `setNewRoutePath`. You'll see what this method does in a moment.

. `push` method: This is like the `addPage` method, but with a different name to be in sync with Flutter's `push` and `pop` naming.

. `pushWidget` method: Allows adding a new widget using the argument of type `Widget`. This is what you'll use for navigating to the Details page.

. `addAll` method: Adds a list of pages.

The last overridden method of the `RouterDelegate` is `setNewRoutePath`, which is also the method called by `replaceAll` above. This method clears the list and adds a new page, thereby replacing all the pages that were there before:

```
@override
Future<void> setNewRoutePath(PageConfiguration configuration) {
  final shouldAddPage = _pages.isEmpty ||
      (_pages.last.arguments as PageConfiguration).uiPage !=
```

```
          configuration.uiPage;
  if (shouldAddPage) {
    _pages.clear();
    addPage(configuration);
  }
  return SynchronousFuture(null);
}
```

When an page action is requested, you want to record the action associated with the page. The _setPageAction method will do that. Add:

```
void _setPageAction(PageAction action) {
  switch (action.page.uiPage) {
    case Pages.Splash:
      SplashPageConfig.currentPageAction = action;
      break;
    case Pages.Login:
      LoginPageConfig.currentPageAction = action;
      break;
    case Pages.CreateAccount:
      CreateAccountPageConfig.currentPageAction = action;
      break;
    case Pages.List:
      ListItemsPageConfig.currentPageAction = action;
      break;
    case Pages.Cart:
      CartPageConfig.currentPageAction = action;
      break;
    case Pages.Checkout:
      CheckoutPageConfig.currentPageAction = action;
      break;
    case Pages.Settings:
      SettingsPageConfig.currentPageAction = action;
      break;
    case Pages.Details:
      DetailsPageConfig.currentPageAction = action;
      break;
    default:
      break;
  }
}
```

Now comes the most important method, `buildPages`. This method will return a list of pages based on the current app state:

```
List<Page> buildPages() {
  // 1
  if (!appState.splashFinished) {
    replaceAll(SplashPageConfig);
  } else {
    // 2
    switch (appState.currentAction.state) {
      // 3
      case PageState.none:
        break;
      case PageState.addPage:
        // 4
        _setPageAction(appState.currentAction);
        addPage(appState.currentAction.page);
        break;
      case PageState.pop:
        // 5
        pop();
        break;
      case PageState.replace:
        // 6
        _setPageAction(appState.currentAction);
        replace(appState.currentAction.page);
        break;
      case PageState.replaceAll:
        // 7
        _setPageAction(appState.currentAction);
        replaceAll(appState.currentAction.page);
        break;
      case PageState.addWidget:
        // 8
        _setPageAction(appState.currentAction);
        pushWidget(appState.currentAction.widget, appState.currentAction.page);
        break;
      case PageState.addAll:
        // 9
        addAll(appState.currentAction.pages);
```

```
        break;
    }
  }
  // 10
  appState.resetCurrentAction();
  return List.of(_pages);
}
```

. If the splash screen hasn't finished, just show the splash screen.

. Switch on the current action state.

. If there is no action, do nothing.

. Add a new page, given by the action's page variable.

. Pop the top-most page.

. Replace the current page.

. Replace all of the pages with this page.

. Push a widget onto the stack (Details page)

. Add a list of pages.

. Reset the page state to none.

`RouterDelegate` is a lot to take in. Take a break to digest what you just learned. :]

RouteInformationParser

A `RouteInformationParser` is a delegate used by `Router` to parse a route's information into a configuration of any type `T` which in your case would be `PageConfiguration`.

This app's `RouteInformationParser` is also known as `ShoppingParser`. Make this class extend from `RouteInformationParser`. To begin, create a new Dart file, *shopping_parser.dart*, in the *router* directory and add the following code to this file:

```
import 'package:flutter/material.dart';
import 'ui_pages.dart';

class ShoppingParser extends RouteInformationParser<PageConfiguration> {
}
```

`RouterInformationParser` requires that its subclasses override `parseRouteInformation` and `restoreRouteInformation`.

`parseRouteInformation` converts the given route information into parsed data — `PageConfiguration` in this case — to pass to `RouterDelegate`:

```
@override
Future<PageConfiguration> parseRouteInformation(
      RouteInformation routeInformation) async {
  // 1
  final uri = Uri.parse(routeInformation.location);
  // 2
  if (uri.pathSegments.isEmpty) {
    return SplashPageConfig;
  }

  // 3
  final path = uri.pathSegments[0];
    // 4
  switch (path) {
    case SplashPath:
      return SplashPageConfig;
    case LoginPath:
      return LoginPageConfig;
    case CreateAccountPath:
      return CreateAccountPageConfig;
    case ListItemsPath:
      return ListItemsPageConfig;
    case DetailsPath:
      return DetailsPageConfig;
    case CartPath:
      return CartPageConfig;
    case CheckoutPath:
      return CheckoutPageConfig;
    case SettingsPath:
      return SettingsPageConfig;
    default:
      return SplashPageConfig;
  }
}
```

Here's what's happening in the code above:

. `location` from `routeInformation` is a *String* that represents the location of the application. The string is usually in the format of multiple string identifiers with slashes between — for example: `/`, `/path` or `/path/to/the/app`. It's equivalent to the URL in a web application. Use `parse` from `Uri` to create a `Uri` from this *String*.

. If there are no paths, which is most likely the case when the user is launching the app, return `SplashPage`.

. Otherwise, get the first path segment from the `pathSegements` list of the `uri`.

. Then return the `PageConfiguration` corresponding to this first path segment.

`restoreRouteInformation` isn't required if you don't opt for the route information reporting, which is mainly used for updating browser history for web applications. If you decide to opt in, you must also override this method to return `RouteInformation` based on the provided `PageConfiguration`.

So, override `restoreRouteInformation`. In a way, this method does the exact opposite of the previously defined `parseRouteInformation` by taking in a `PageDate` and returning an object of type `RouteInformation`:

```
@override
RouteInformation restoreRouteInformation(PageConfiguration configuration) {
  switch (configuration.uiPage) {
    case Pages.Splash:
      return const RouteInformation(location: SplashPath);
    case Pages.Login:
      return const RouteInformation(location: LoginPath);
    case Pages.CreateAccount:
      return const RouteInformation(location: CreateAccountPath);
    case Pages.List:
      return const RouteInformation(location: ListItemsPath);
    case Pages.Details:
      return const RouteInformation(location: DetailsPath);
    case Pages.Cart:
      return const RouteInformation(location: CartPath);
    case Pages.Checkout:
      return const RouteInformation(location: CheckoutPath);
    case Pages.Settings:
      return const RouteInformation(location: SettingsPath);
    default:
      return const RouteInformation(location: SplashPath);
  }
}
```

This method uses `uiPage` from `Page` to return a `RouteInformation` with its `location` set to the given path. Notice that there's a `RouteInformation` with the location of `SplashPath` in case there are no matches for `uiPage`.

Root Widget and Router

Now that you have all the required `Router` classes, hook them up with the root widget of your app in the *main.dart* file. Open *main.dart* and find:

```
// TODO Create Delegate, Parser and Back button Dispatcher
```

Define instances of `ShoppingRouterDelegate` and `ShoppingParser`.

```
ShoppingRouterDelegate delegate;
final parser = ShoppingParser();
```

Then, replace `// TODO Setup Router & dispatcher` with the following:

```
// 1
  delegate = ShoppingRouterDelegate(appState);
// 2
  delegate.setNewRoutePath(SplashPageConfig);
```

In the code above, you:

Create the delegate with the appState field.

Set up the initial route of this app to be the Splash page using `setNewRoutePath`.

Add any needed imports. For most Flutter apps, you might have `MaterialApp` or `CupertinoApp` as the root widget. Both of these use `WidgetsApp` internally. `WidgetsApp` creates a `Router` or a `Navigator` internally. In case of a `Router`, the `Navigator` is configured via the provided `routerDelegate`. `Navigator` then manages the pages list that updates the app's navigation whenever this list of pages changes.

Since Navigator 2.0 is backward-compatible with Navigator 1.0, the easiest way to start with Navigator 2.0 is to use `MaterialApp`'s `MaterialApp.router(...)` constructor. This requires you to provide instances of a `RouterDelegate` and a `RouteInformationParser` as the ones discussed above.

Hence, in the root widget's `build` method, replace `MaterialApp` with:

```
child: MaterialApp.router(
  title: 'Navigation App',
  debugShowCheckedModeBanner: false,
  theme: ThemeData(
      primarySwatch: Colors.blue,
      visualDensity: VisualDensity.adaptivePlatformDensity,
  ),
  routerDelegate: delegate,
  routeInformationParser: parser,
),);
```

Notice that you're passing in the created `routerDelegate` and `routeInformationParser`. Run the app to make sure it still works.

Navigating Between Pages

Now you'll cover how to navigate between the various pages.

Splash Page Navigation

Open *splash.dart* from the *ui* folder and find `appState.setSplashFinished()`. If you go to `setSplashFinished()` you will see:

```
void setSplashFinished() {
  // 1
  _splashFinished = true;
  if (_loggedIn) {
    // 2
    _currentAction = PageAction(state: PageState.replaceAll, page: ListItemsPageConfig);
  } else {
```

```
    // 3
    _currentAction = PageAction(state: PageState.replaceAll, page: LoginPageConfig);
  }
  notifyListeners();
}
```

Set the splash state to be finished.
If the user is logged in, show the list page.
Otherwise show the login page.
By setting the current action and calling `notifyListeners`, you will trigger a state change and the router will update its list of pages based on the current app state.

BackButtonDispatcher

Navigator 2.0 also uses a `BackButtonDispatcher` class to handle system back button presses. If you want to create a custom dispatcher, you can create a subclass of `RootBackButtonDispatcher`.
This app's `BackButtonDispatcher` is also known as `ShoppingBackButtonDispatcher`. Create this class by creating a new Dart file named *back_dispatcher.dart* in the *router* directory and adding the following code:

```
import 'package:flutter/material.dart';
import 'router_delegate.dart';

// 1
class ShoppingBackButtonDispatcher extends RootBackButtonDispatcher {
  // 2
  final ShoppingRouterDelegate _routerDelegate;

  ShoppingBackButtonDispatcher(this._routerDelegate)
      : super();

  // 3
  Future<bool> didPopRoute() {
    return _routerDelegate.popRoute();
  }
}
```

In the code above:

. Make `ShoppingBackButtonDispatcher` extend `RootBackButtonDispatcher`.

. Declare a `final` instance of `ShoppingRouterDelegate`. This helps you link the dispatcher to the app's `RouterDelegate`, i.e. `ShoppingRouterDelegate`.

. Delegate `didPopRoute` to `_routerDelegate`.

Note that this class doesn't do any complex back button handling here. Rather, it's just an example of subclassing `RootBackButtonDispatcher` to create a custom *Back Button Dispatcher*. If you need to do some custom back button handling, add your code to `didPopRoute()`.
To use this class open *main.dart*, add the import statement and add the initializing code after `final parser = ShoppingParser();`:

```
ShoppingBackButtonDispatcher backButtonDispatcher;
```

Then initialize `backButtonDispatcher` in `_MyAppState` after `delegate.setNewRoutePath(SplashPage);`:

```
backButtonDispatcher = ShoppingBackButtonDispatcher(delegate);
```

Finally, use this dispatcher in your router in the `build` method by adding it before the `routerDelegate: delegate,` statement:

```
backButtonDispatcher: backButtonDispatcher,
```

This time, use *Hot Restart* instead of *Hot Reload* to restart the app. Then, observe there aren't changes to the flow of navigation because, as mentioned earlier, the `didPopRoute` in `ShoppingBackButtonDispatcher` does nothing special.

Deep Linking

To implement deep links, this tutorial uses the *uni_links* package.
This package helps with deep links on Android, as well as *Universal Links* and *Custom URL Schemes* on iOS. To handle deep links on Android, modify the *AndroidManifest.xml* file in the *android/app/src/main* directory. For Android, add an `<intent-filter>` tag inside the `MainActivity`'s `<activity>` tag as follows:

```
<intent-filter>
  <action android:name="android.intent.action.VIEW" />
  <category android:name="android.intent.category.DEFAULT" />
  <category android:name="android.intent.category.BROWSABLE" />
  <data
     android:scheme="navapp"
     android:host="deeplinks" />
  </intent-filter>
```

For iOS, modify *ios/Runner/Info.plist* by adding:

```
<key>CFBundleURLTypes</key>
<array>
  <dict>
        <key>CFBundleTypeRole</key>
        <string>Editor</string>
        <key>CFBundleURLName</key>
        <string>deeplinks</string>
        <key>CFBundleURLSchemes</key>
        <array>
                <string>navapp</string>
        </array>
        </dict>
```

```
</array>
```

Both of these changes add a scheme named *navapp* to the app where *navapp* means *Navigation App*. In terms of deep links, this means this app can open URLs that look like *navapp://deeplinks*. You can use whatever scheme you like as long as it's unique.
Now that you know how to make deep links open your app, follow the steps below to understand how to consume the link the user clicked on.

Parse Deep Link URI

Open the *router_delegate.dart* file and add `parseRoute`, which takes a `Uri` as an argument, parses the *path* and sets the *page*(s):

```
void parseRoute(Uri uri) {
// 1
  if (uri.pathSegments.isEmpty) {
    setNewRoutePath(SplashPageConfig);
    return;
  }

// 2
  // Handle navapp://deeplinks/details/#
  if (uri.pathSegments.length == 2) {
    if (uri.pathSegments[0] == 'details') {
// 3
      pushWidget(Details(int.parse(uri.pathSegments[1])), DetailsPageConfig);
    }
  } else if (uri.pathSegments.length == 1) {
    final path = uri.pathSegments[0];
// 4
    switch (path) {
      case 'splash':
        replaceAll(SplashPageConfig);
        break;
      case 'login':
        replaceAll(LoginPageConfig);
        break;
      case 'createAccount':
// 5
        setPath([
          _createPage(Login(), LoginPageConfig),
          _createPage(CreateAccount(), CreateAccountPageConfig)
        ]);
        break;
      case 'listItems':
        replaceAll(ListItemsPageConfig);
        break;
      case 'cart':
        setPath([
          _createPage(ListItems(), ListItemsPageConfig),
          _createPage(Cart(), CartPageConfig)
        ]);
        break;
      case 'checkout':
        setPath([
          _createPage(ListItems(), ListItemsPageConfig),
          _createPage(Checkout(), CheckoutPageConfig)
        ]);
        break;
      case 'settings':
        setPath([
          _createPage(ListItems(), ListItemsPageConfig),
          _createPage(Settings(), SettingsPageConfig)
        ]);
        break;
    }
  }
}
```

In the code above:

. Check if there are no `pathSegments` in the URI. If there are, navigate to the *Splash* page.

. Handle the special case for the *Details* page, as the `path` will have two `pathSegments`.

. Parse the item number and push a Details page with the item number. In a real app, this item number could be a product's unique ID.

. Use `path` as an input for the `switch` case.

. In this case and other cases, push the pages necessary to navigate to the destination using `setPath`.

Next, to link `parseRoute` to the root widget's `router`, open *main.dart*.
Add the following code after `ShoppingBackButtonDispatcher backButtonDispatcher;`:

```
StreamSubscription _linkSubscription;
```

`_linkSubscription` is a `StreamSubscription` for listening to incoming links. Call `.cancel()` on it to dispose of the stream.
To do so, add:

```
  _linkSubscription?.cancel();
```

before `super.dispose();`. Now add the missing `initPlatformState`, which is responsible for setting up the listener for the deep links:

```
// Platform messages are asynchronous, so declare them with the async keyword.
Future<void> initPlatformState() async {
  // Attach a listener to the Uri links stream
// 1
  _linkSubscription = getUriLinksStream().listen((Uri uri) {
    if (!mounted) return;
    setState(() {
// 2
      delegate.parseRoute(uri);
    });
  }, onError: (Object err) {
    print('Got error $err');
  });
}
```

Here's what you do in the code above:

. Initialize `StreamSubcription` by listening for any deep link events.

. Have the app's `delegate` parse the `uri` and then navigate using the previously defined `parseRoute`.

At this point, you've implemented deep links, so stop the running instance of your app and re-run it to include these changes. Don't use hot restart or hot reload because there were changes on the native Android and native iOS side of the project and they aren't considered by these two tools.

Testing Android URIs

To test your deep links on Android, the easiest way is from the command line.

Open *Terminal* on macOS or Linux or *CMD* on Windows and verify that the app navigates to the Settings page using the following *adb* shell command:

```
adb shell 'am start -W -a android.intent.action.VIEW -c android.intent.category.BROWSABLE -d "navapp://deeplinks/settings"'
```

Notice that this *adb* command includes the app's deep link `scheme` `navapp` and `host` `deeplinks` from *Android Manifest.xml*.

To navigate to the *Details* page with the index of the item as `1`, try the following command:

```
adb shell 'am start -W -a android.intent.action.VIEW -c android.intent.category.BROWSABLE -d "navapp://deeplinks/details/1"'
```

To navigate to the *Cart* page, try the following command:

```
adb shell 'am start -W -a android.intent.action.VIEW -c android.intent.category.BROWSABLE -d "navapp://deeplinks/cart"'
```

You'll see your app navigates to the target page. If that's not the case, check the logs to see if there are any errors.

Where to Go From Here?

Download the final version of this project using the *Download Materials* button at the top or bottom of this tutorial.

Congratulations! That was a lot of code, but it should help you whenever you plan to implement your own *RouterDelegate* with Navigator 2.0.

Check out the following links to learn more about some of the concepts in this tutorial:

Navigator 2.0: Navigator Refactoring.

Github Issue: Navigator 2.0 Refactoring

Navigator 2.0 Design Doc: Navigator 2.0 and Router

Get: Counter app using Get example

uni_links

We hope you enjoyed this tutorial, and if you have any questions or comments, please join the forum discussion below!

Reviews

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