iOS Meetup Munich

XCoordinator

A powerful navigation library for iOS

What we will build

We will refactor a MVC app to encapsulate transition logic and manage inter-scene dependencies with XCoordinator.

What you will learn

What the Coordinator pattern is
How to make inter-scene dependencies clear
How XCoordinator makes code transitions easier
How to use animations in XCoordinator
Deep links, Reactive extensions & more

Key Vocabulary

- Coordinator pattern
- XCoordinator
- Transitions
- Animations
- Dependencies
- Swift

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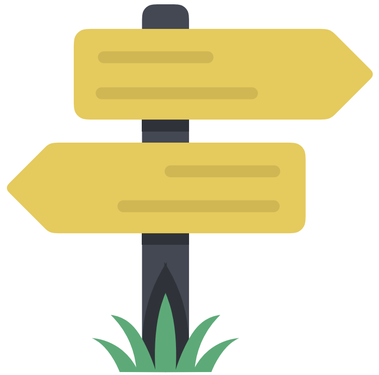
Agenda

Common practice

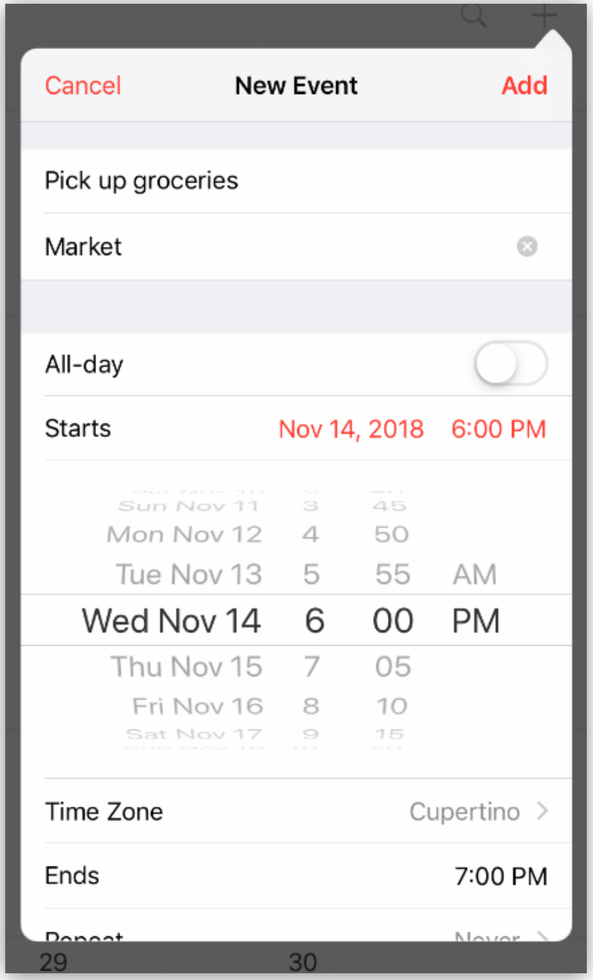
Coordinator pattern

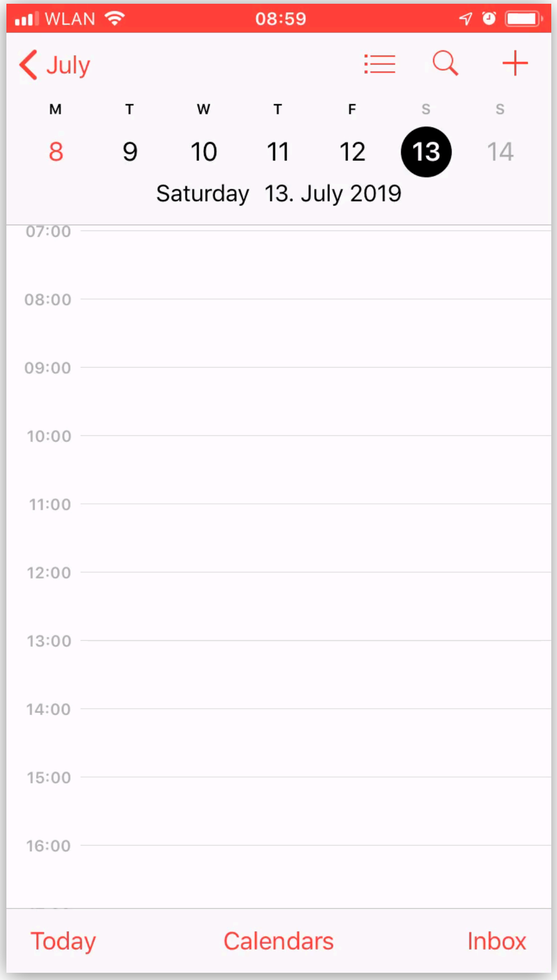


XCoordinator

Live coding

What are transitions?

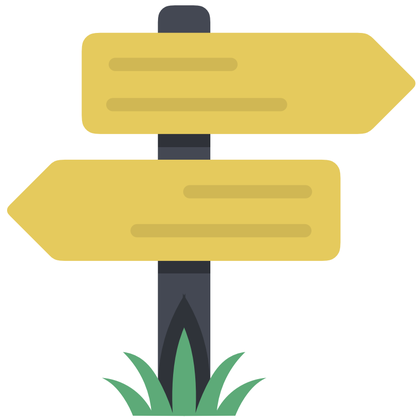




Navigation techniques

Storyboard Segues

UIKit transition code



XCoordinator

Storyboard Segues

```
override func prepare(for segue: UIStoryboardSegue,
                      sender: Any?) {
    switch segue.identifier {
    case "PushNewViewController":
        guard let viewController =
            segue.destination as? NewViewController else {
            return assertionFailure()
        }
        viewController.data = Data()
    default:
        assertionFailure()
    }
}
```

String constants

assumptions about viewController context

viewController-dependent transitions

no type-safety for transition destination

Transitions in code

```
@IBAction func loginButtonTapped(_ sender: UIButton) {
    guard let navigationController = navigationController else {
        return assertionFailure()
    }

    let viewController = NewViewController()
    viewController.data = Data()
    navigationController.pushViewController(viewController, animated: true)
}
```

no String constants

assumptions about viewController context

viewController-dependent transitions

type-safety for transition destination

Transitions using a Coordinator pattern

LoginViewController:

```
@IBAction func loginButtonTapped(_ sender: UIButton) {
    coordinator.trigger(.loginSuccessful)
}
```

LoginCoordinator:

```
override func prepareTransition(for route: LoginRoute) -> NavigationTransition {
    switch route {
    case .loginSuccessful:
        let viewController = NewViewController()
        viewController.data = Data()
        return .push(viewController)
    }
}
```

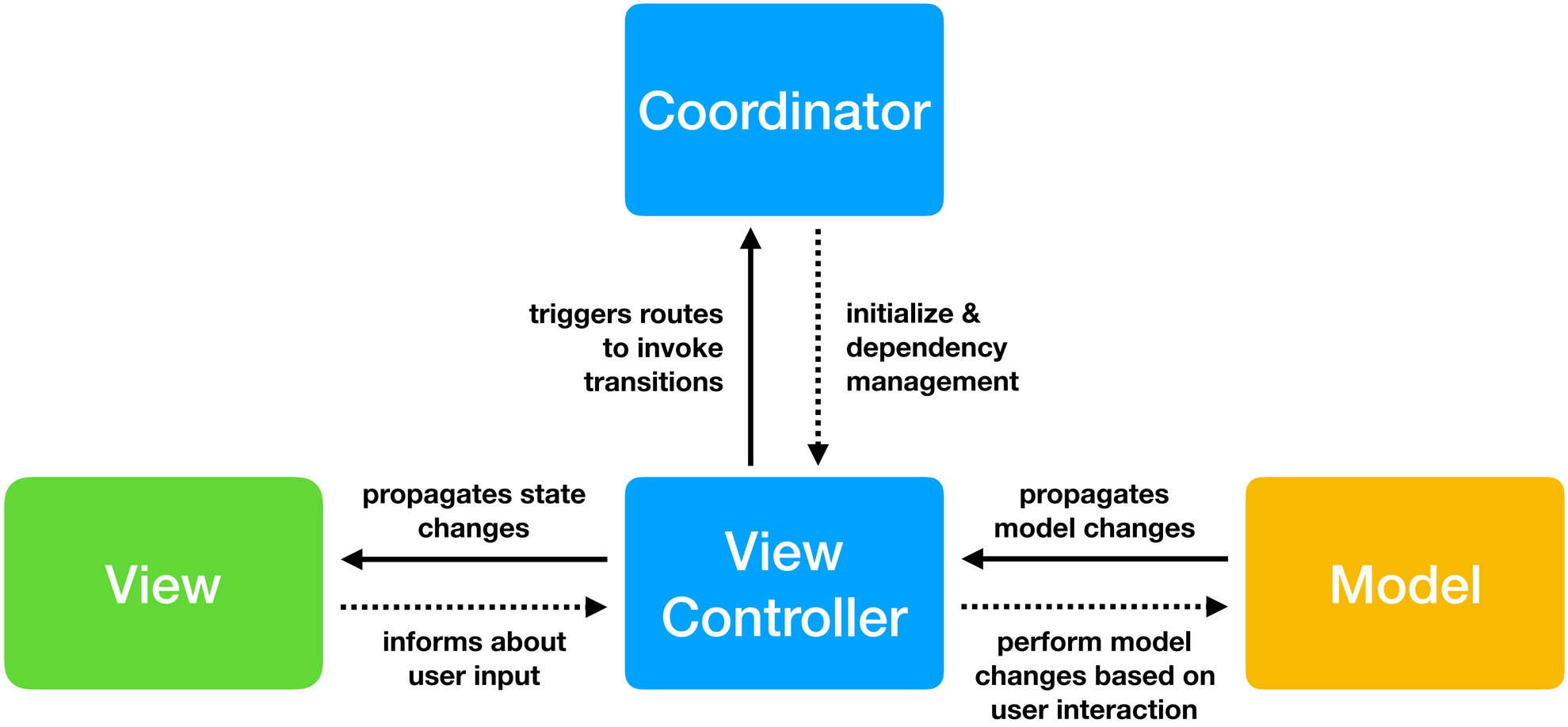
no String constants

no assumptions about viewController context

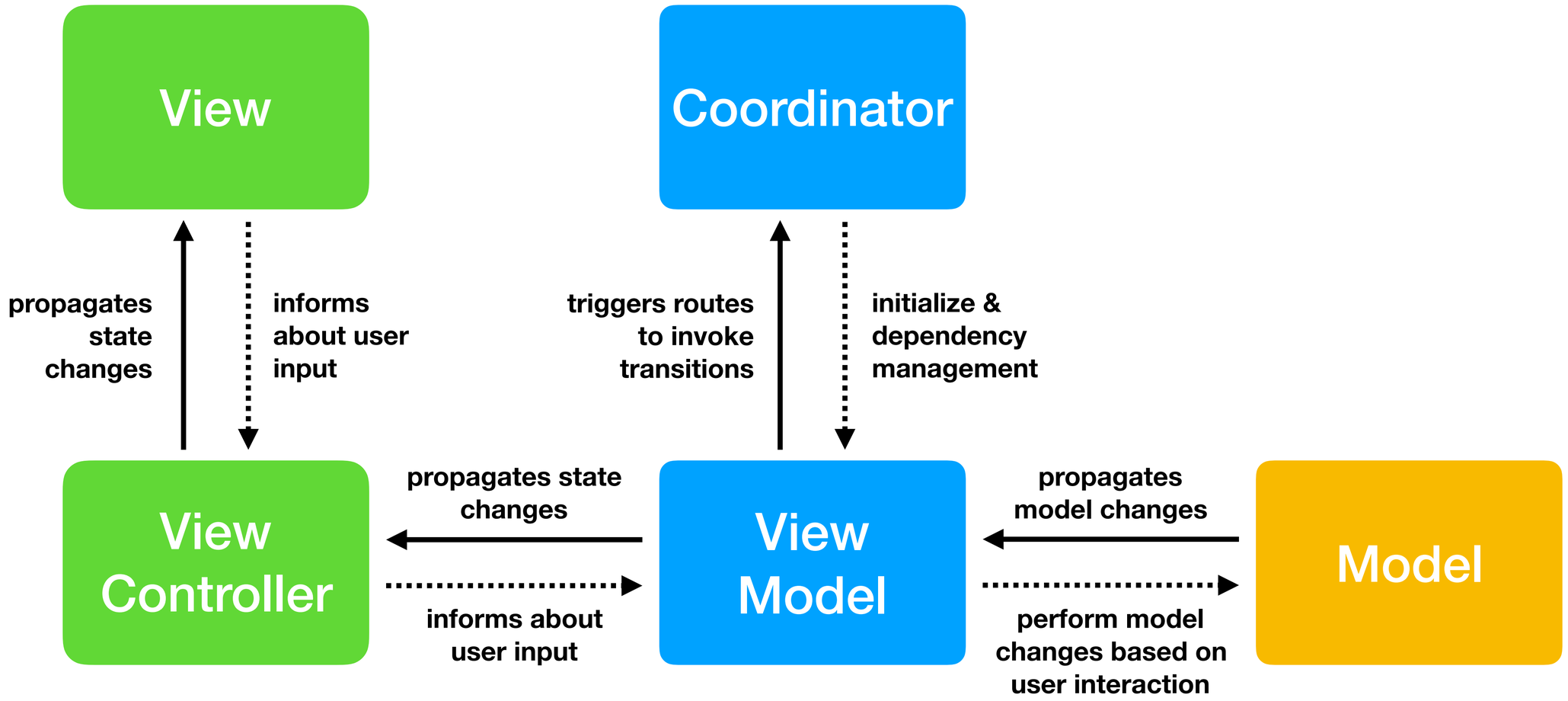
viewController-independent transitions

type-safety for transition destination

Coordinator pattern in MVC



Coordinator pattern in MVVM



Coordinator Pattern?

👍🏻 **Separation of concerns**

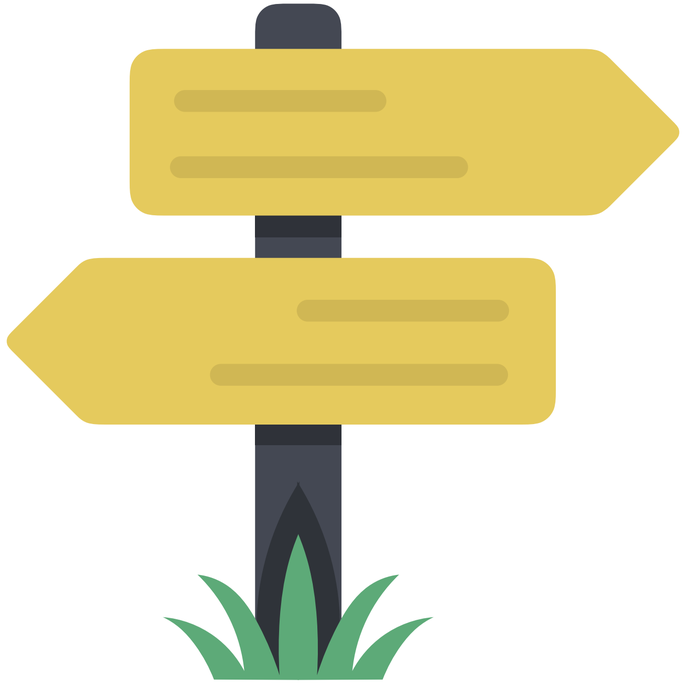
👍🏻 **Flow-independent, reusable scenes / view controllers**

👍🏻 **Easily changeable navigation logic**

👎🏻 **Programming overhead**

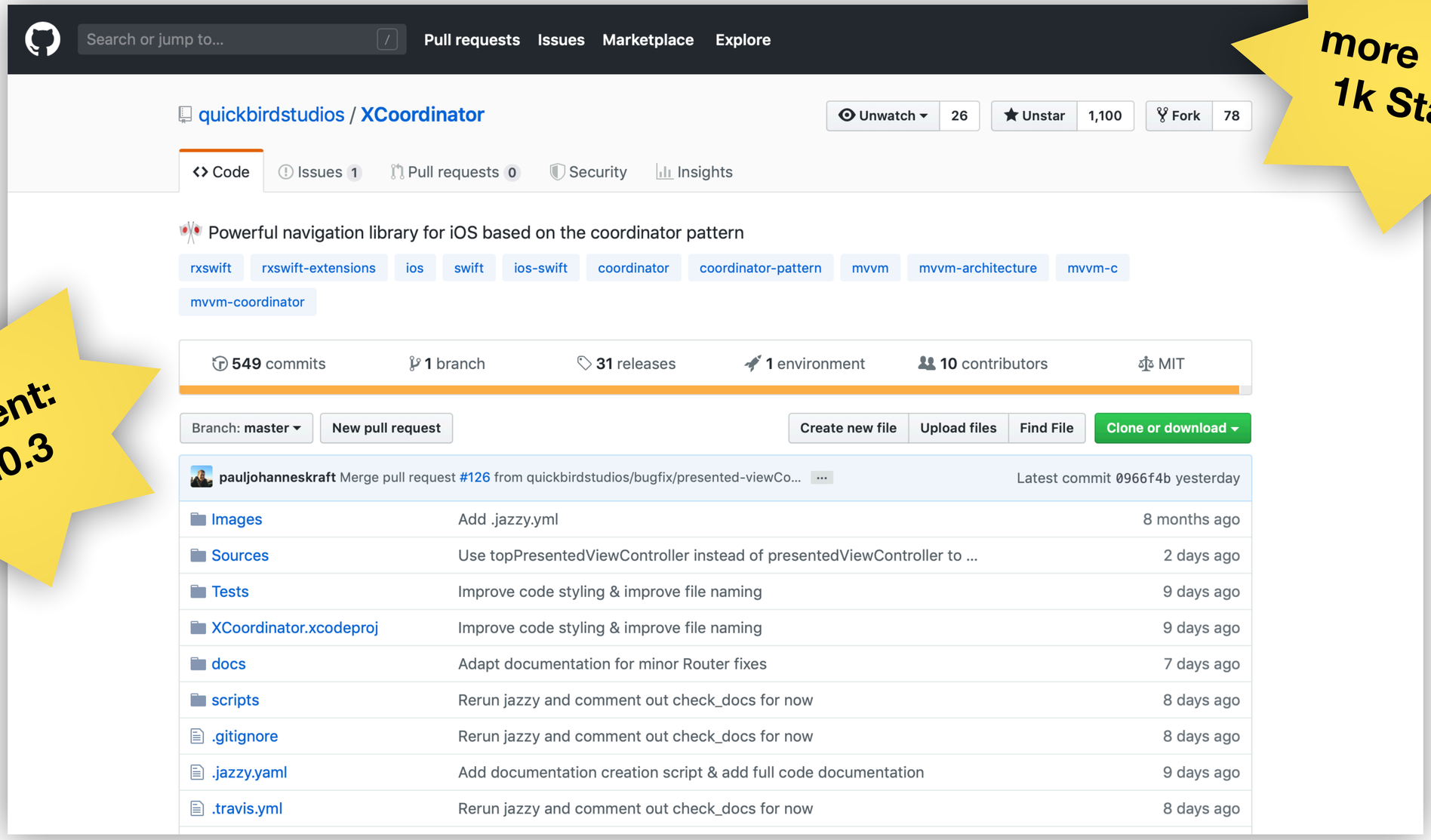
👎🏻 **Not the “standard way”**

And that’s how we got to build…



XCoordinator

XCoordinator is on GitHub!



more than 1k Stars

Current: v2.0.3

Apps we built with XCoordinator

soundperience LINOVA SOFTWARE GMBH

Soundfit Pro

ZEPPELIN CATERPILLAR

Operator Challenge

Lufthansa

Design Discovery

XSTUDY

Schultopf

Why use XCoordinator?

🌓 **Many different predefined transitions**

🏃‍♂️ **Simpler, consistent transition animation interface**

🔩 **Specialized coordinators for most use cases, generic BaseCoordinator**

👨‍✈️ **Fast switching of coordinators without changing viewController code**

🛤 **Deep Linking of routes of different types**

🚀 **RxSwift & Combine extensions**

 Route

Declaration:

```
enum LoginRoute: Route {
    case loginSuccessful
    case loginFailed
    case url(URL)
}
```

Usage (in ViewController or ViewModel):

```
coordinator.trigger(.loginSuccessful)
```

👨‍✈️ Coordinator

- Has a rootViewController
- Prepares transitions for triggered routes by initializing scenes
- performs transitions between scenes

```
class LoginCoordinator: ViewCoordinator<LoginRoute> {

    init() {
        let viewController = LoginViewController()
        super.init(rootViewController: viewController,
                   initialRoute: nil)
        viewController.router = unownedRouter
    }

    override func prepareTransition(
        for route: LoginRoute
        ) -> ViewTransition {
        /* … */
    }

}
```

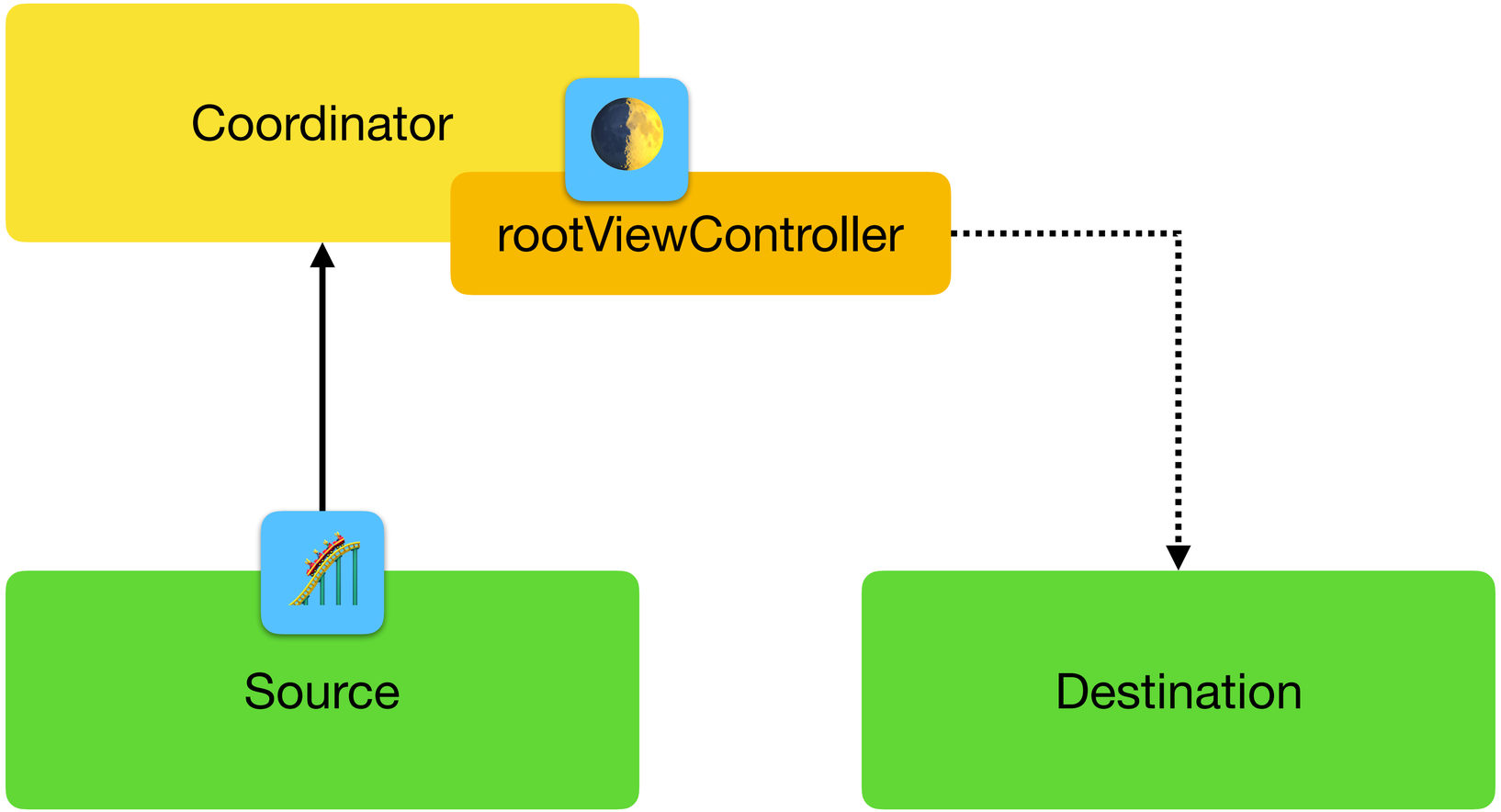
👨🏻‍✈️ Coordinator: Defining transitions

```
class LoginCoordinator: ViewCoordinator<LoginRoute> {
    /* … */

    override func prepareTransition(for route: LoginRoute) -> ViewTransition {
        switch route {
        case .loginSuccessful:
            let coordinator = HomeCoordinator()
           return .present(coordinator)
        case .loginFailed:
            let alert = createLoginFailedAlertController()
            return .present(alert)
        }
    }
}
```

👨‍✈️ Coordinator: Router Abstractions

- **Goals**
  - Remove context type information from Coordinator (i.e. which rootViewController type is used) —> Reusability, e.g. iPad / iPhone
  - Restrict Coordinator in ViewController/ViewModel to **trigger** method
  - Want to be able to hold a strong/weak/unowned reference to coordinators
- **Router Types**
  - **StrongRouter** (holds strong reference): Used in AppDelegate or for holding child coordinators
  - **UnownedRouter** (holds unowned reference): Used in ViewController/ViewModel or for holding parent coordinators
  - **WeakRouter** (holds weak reference): Used in ViewController/ViewModel or for holding parent coordinators - when coordinator might not exist anymore, when accessing it

How routes are triggered



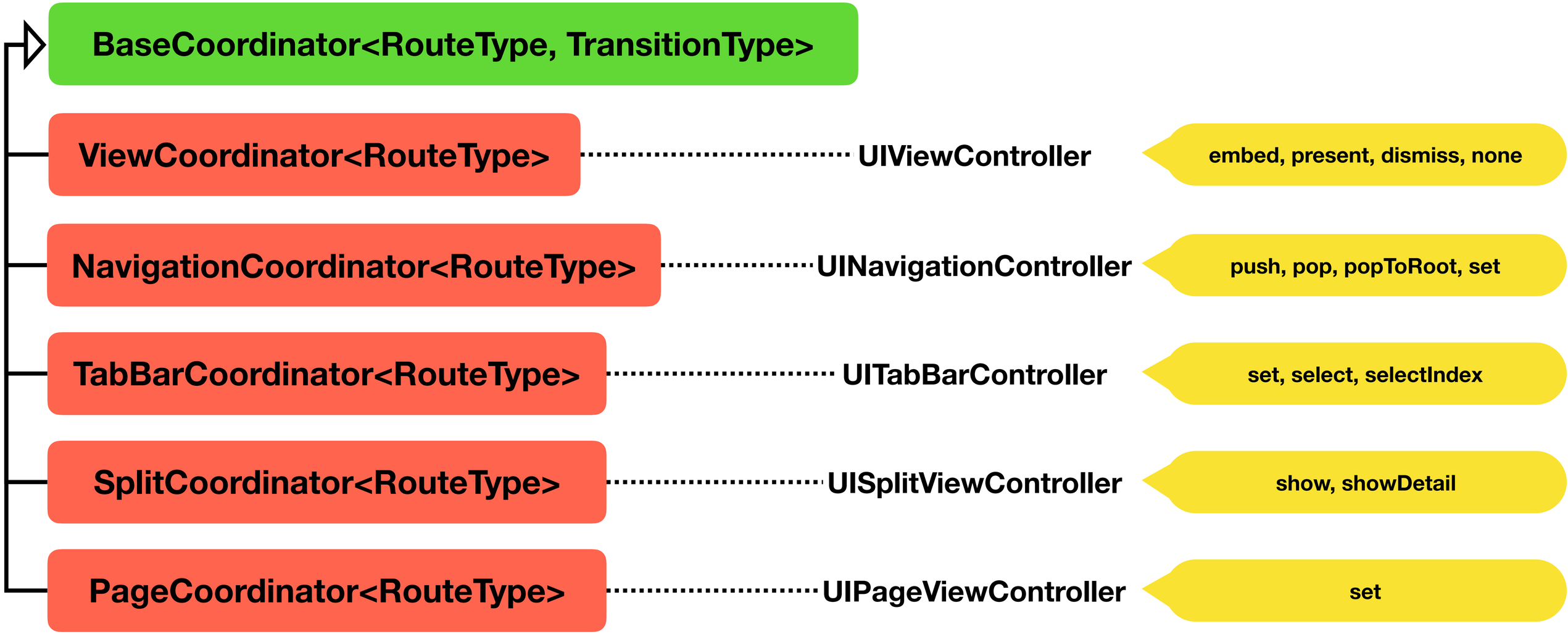
What is a Coordinator?

- **init(rootViewController:initialRoute:)**
- **trigger(_:with:completion:)**
- **prepareTransition(for:)**

What is a Coordinator?

- **init(rootViewController:initialRoute:)**
  - You can trigger a route right at initialisation time
  - Depending on the Coordinator type, there might be other options
  - Inject your custom rootViewController here - there is no possibility to change it afterwards.
- **trigger(_:with:completion:)**
  - Triggers a route, options can define to (not) animate the transition
- **prepareTransition(for:)**
  - Prepares transitions for a given route - might not be the same for different coordinator implementations of the same route

Coordinator & Transition types



Let’s integrate XCoordinator in our app!

Munich iOS

Introduce XCoordinator to your app

- **Create Route enum cases** for all possible segues or transition code segments
- **Add UnownedRouter** of the created Route-enum to the viewControllers handling transitions and replace the transition code / segues with triggering of routes
- **Implement a Coordinator** by overriding the prepareTransition(for:) method
- Make sure to **use the Coordinator** 😉

Exercise: Integrating XCoordinator

Task 1: Create LoginCoordinator & use as initial coordinator

Task 2: Create HomeCoordinator as TabBarCoordinator

Munich iOS

Solution 1: LoginCoordinator

Create **LoginRoute.swift** in **Routing**

- Create a LoginRoute enum with one case for each possible transition of that flow
- Introduce an `UnownedRouter<LoginRoute>` into `LoginViewController` and replace transition logic with triggering routes
- Create a LoginCoordinator as a ViewCoordinator
  - Override `generateRootViewController` to create a `LoginViewController` as the coordinator's rootViewController
  - Override `prepareTransition(for:)` to prepare transitions for the given routes
  - Create an empty initializer to make sure, the coordinator is always correctly initialized
- Use `coordinator.setRoot` to set the rootViewController of the app's window
- Try it out! Check, if everything still works.

Solution 2: HomeCoordinator

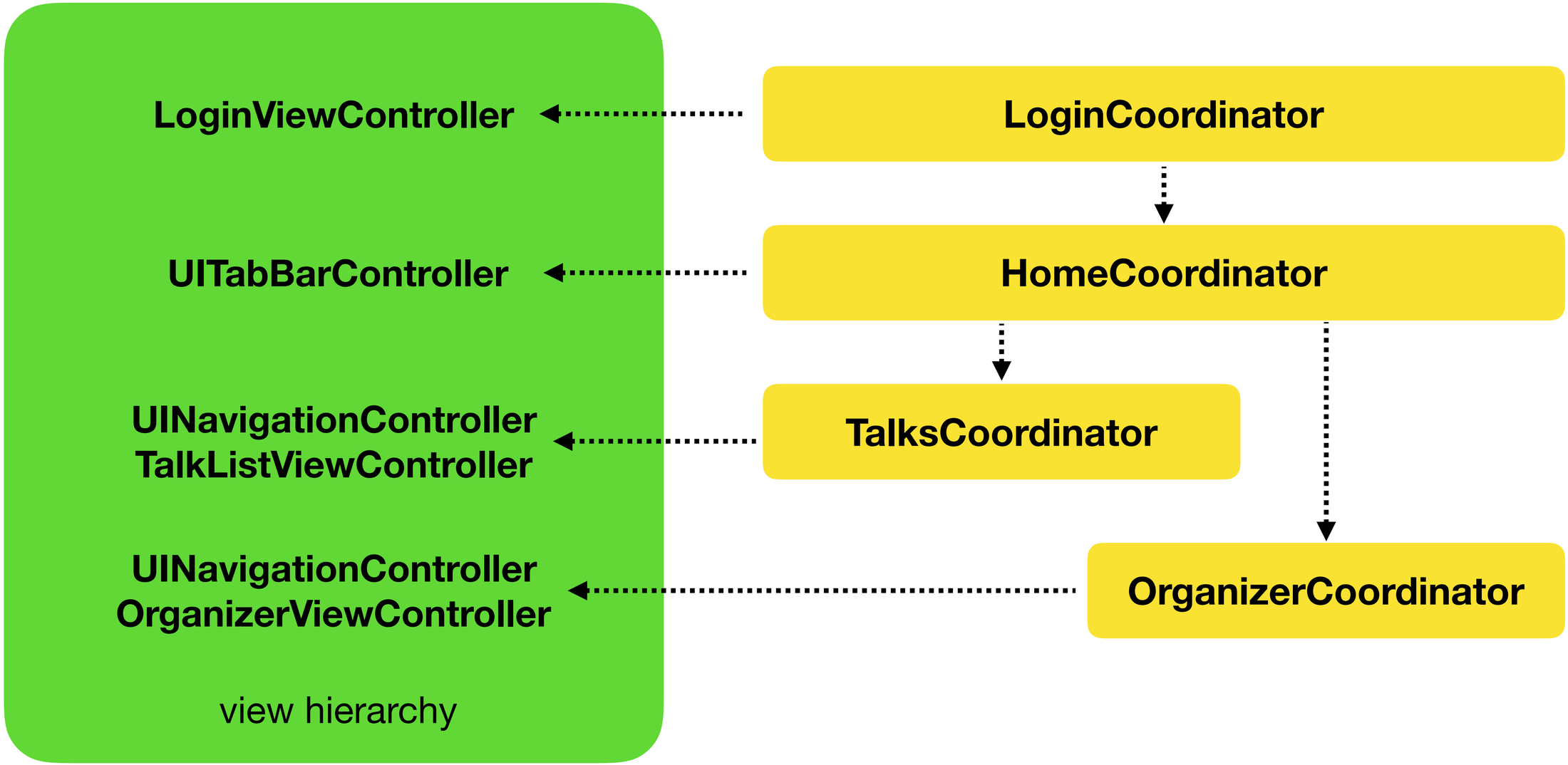
Create **HomeRoute.swift** in **Routing**

- Identify `HomeCoordinator` as a useful abstraction
- Create a `HomeRoute` with only an `initial` route, since there are no interactions possible
- Implement `HomeCoordinator` as a `TabBarCoordinator`
  - Create empty initializer to make sure it is always correctly initialized
  - Override `prepareTransition(for:)` to provide transitions for triggered routes
- Change `prepareTransition(for:)` in `LoginCoordinator` to present the coordinator instead of creating viewControllers

What did we achieve? 🎉

- Abstraction from transition logic & individual scenes/viewControllers
  - You can easily swap out, which transition is performed, when a route is triggered without the need of changing a viewController —> higher reusability
- Type-safe transitions (You cannot trigger a push transitions on a UITabBarController)
- Simpler transition animation interface
- Creation of scenes and connected model data at one place
  - You can also pass data using associated values in enum cases, if you want/need to pass data

Coordinator hierarchies



When do I need a new Route/Coordinator?

- **Rule of thumb:** new rootViewController to perform transitions on
- New Context
  - creation/editing of a model element
  - tabs in a UITabBarController that have distinct features
- Presentation of new Scene
- Restricting access of certain scenes to specific routes (see also **RedirectionRouter**)

Exercise: Finishing up integration

Task 1 (TalksRoute.swift): Introduce a TalksCoordinator

Task 2 (HomeRoute.swift): Make sure to highlight the Organizer-tab when routing to the Home route

Task 3 (OrganizerRoute.swift): Introduce an OrganizerCoordinator

Task 4 (LoginRoute.swift): Add login input validation

Solution 1.1 - Slide 1/2

- Create **TalksRoute** in **TalksRoute.swift**

```
enum TalksRoute: Route {
    case initial
}
```

Solution 1.1 - Slide 2/2

- Create **TalksCoordinator** in **TalksRoute.swift**

```
class TalksCoordinator: NavigationCoordinator<TalksRoute> {

    init() {
        super.init(initialRoute: .initial)
    }

    override func prepareTransition(for route: TalksRoute) -> NavigationTransition {
        switch route {
        case .initial:
            let viewController = TalkListViewController()
            viewController.talks = Model.createTalks()
            viewController.router = unownedRouter
            return .push(viewController)
        }
    }
}
```

Solution 1.2 - Slide 1/2

- Adapt **TalksRoute** in **TalksRoute.swift**

```
enum TalksRoute: Route {
    case initial
    case detail(Talk)
}
```

- Adapt **prepareTransition(for:)** in **TalksCoordinator**

```
case let .detail(talk):
    let viewController = TalkDetailViewController()
    viewController.talk = talk
    viewController.router = unownedRouter
    return .push(viewController, animation: .fade)
```

(optional) Solution 1.3

Solution 1.2 - Slide 2/2

- Add **router** property to **TalksViewController** in **TalksViewController.swift**

```
class TalkListViewController: UIViewController {
    /* .. */
    var router: UnownedRouter<TalksRoute>!
}
```

- Trigger detail route in **tableView(_:didSelectRowAt:)**

```
extension TalkListViewController: UITableViewDelegate {
    func tableView(_ tableView: UITableView,
                   didSelectRowAt indexPath: IndexPath) {
        let model = talks[indexPath.row]
        router.trigger(.detail(model))
    }
}
```

Solution 2

- Use **TalksCoordinator** by adapting **HomeCoordinator** in **HomeRoute.swift**

```
override func prepareTransition(for route: HomeRoute) -> TabBarTransition {
    switch route {
    case .initial:
        let organizerViewController = OrganizerViewController()
        organizerViewController.organizer = Model.createOrganizer()
        let orgaRoot = UINavigationController(rootViewController: organizerViewController)
        let talksCoordinator = TalksCoordinator()
        return .multiple(
            .set([talksCoordinator, orgaRoot]),
            .select(orgaRoot)
        )
    }
}
```

Solution 3.1

- Create **OrganizerRoute** in **OrganizerRoute.swift**

```
enum OrganizerRoute: Route {
    case initial
}
```

Solution 3.1

- Create **OrganizerRoute & OrganizerCoordinator** in **OrganizerRoute.swift**

```
enum OrganizerRoute: Route {
    case initial
}


class OrganizerCoordinator: NavigationCoordinator<OrganizerRoute> {

    init() {
        super.init(initialRoute: .initial)
    }

    override func prepareTransition(for route: OrganizerRoute) -> NavigationTransition {
        switch route {
        case .initial:
            let viewController = OrganizerViewController()
            viewController.organizer = Model.createOrganizer()
            return .push(viewController)
        }
    }
}
```

(Optional) Solution 3.2

- Add **website(URL)** case to **OrganizerRoute**

```
enum OrganizerRoute: Route {
    case initial
    case website(URL)
}
```

- Adapt **prepareTransition(for:)** in **OrganizerCoordinator**

```
case let .website(url):
    UIApplication.shared.open(url)
    return .none()
```

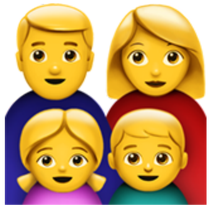
(Optional) Solution 3.2

- Trigger **.website(URL)** in **OrganizerViewController**

```
var router: UnownedRouter<OrganizerRoute>!


@objc private func websiteButtonTapped() {
    guard let url = organizer?.website,
        UIApplication.shared.canOpenURL(url) else {
        return assertionFailure()
    }

    router.trigger(.website(url))
}
```

Don’t forget to set the **router** of the **OrganizerViewController** in the **OrganizerCoordinator**!

Now let’s explore some more advanced features…



Connections between coordinators

Deep Linking

Reactive extensions

Exercise 2: Adding more functionality

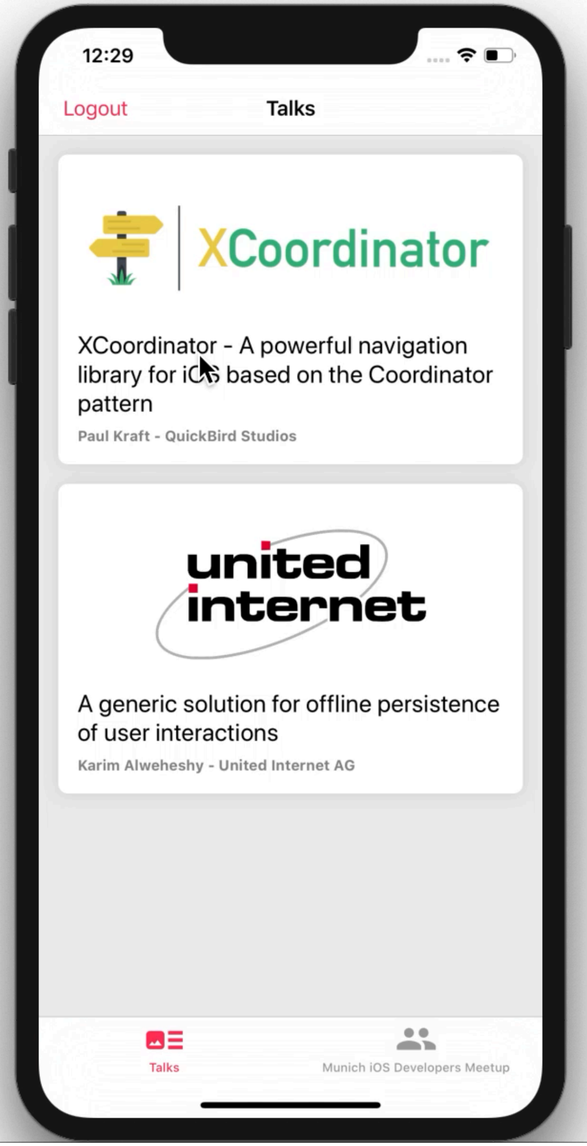
Task 1: Add “Logout” functionality using parent/child coordinators

Task 2: Open URLs using Deep Linking

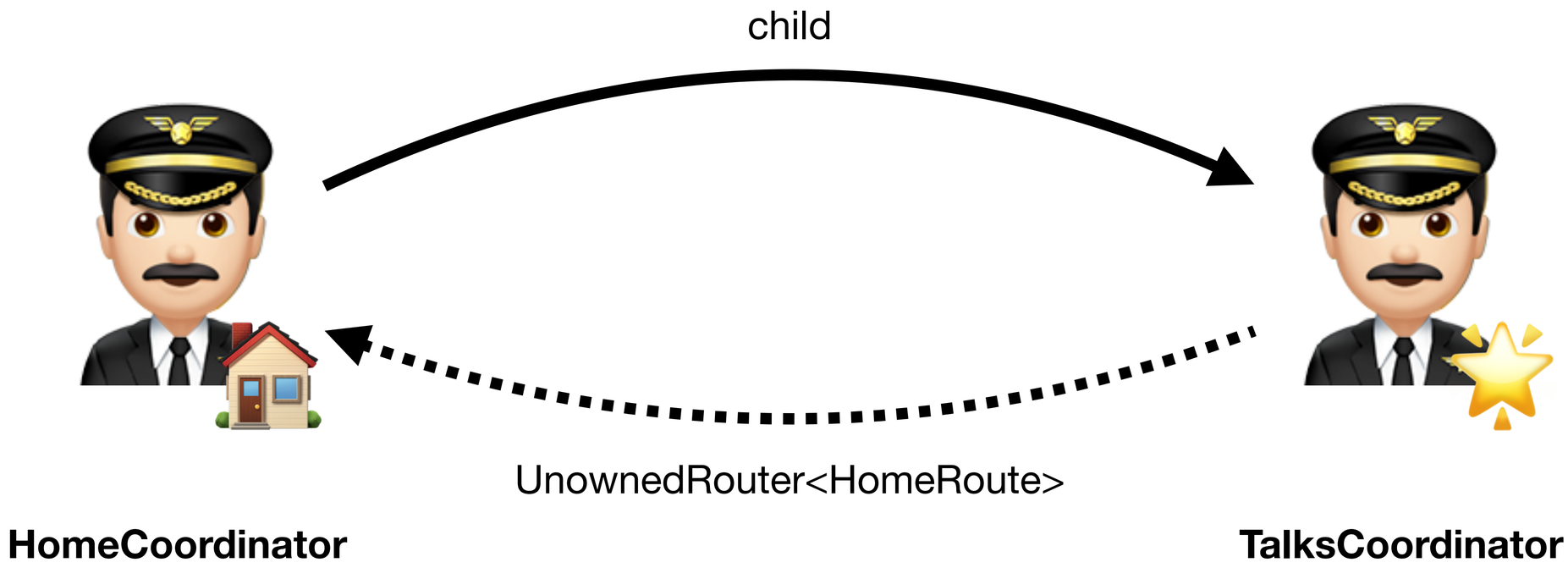
Task 3: Login with reactive streams (RxSwift / Combine)

Task 2.1: Logout

- Dismiss the **UITabBarController** on tap of “Logout” button
- Handle the transition in **HomeCoordinator**, even though **TalkListViewController** only has reference to **TalksCoordinator**
- Keep unowned reference of **HomeCoordinator** in **TalksCoordinator**
- Adapt **prepareTransition**-methods on **HomeCoordinator** and **TalksCoordinator**
- trigger **TalksRoute.logout** in **TalkListViewController**

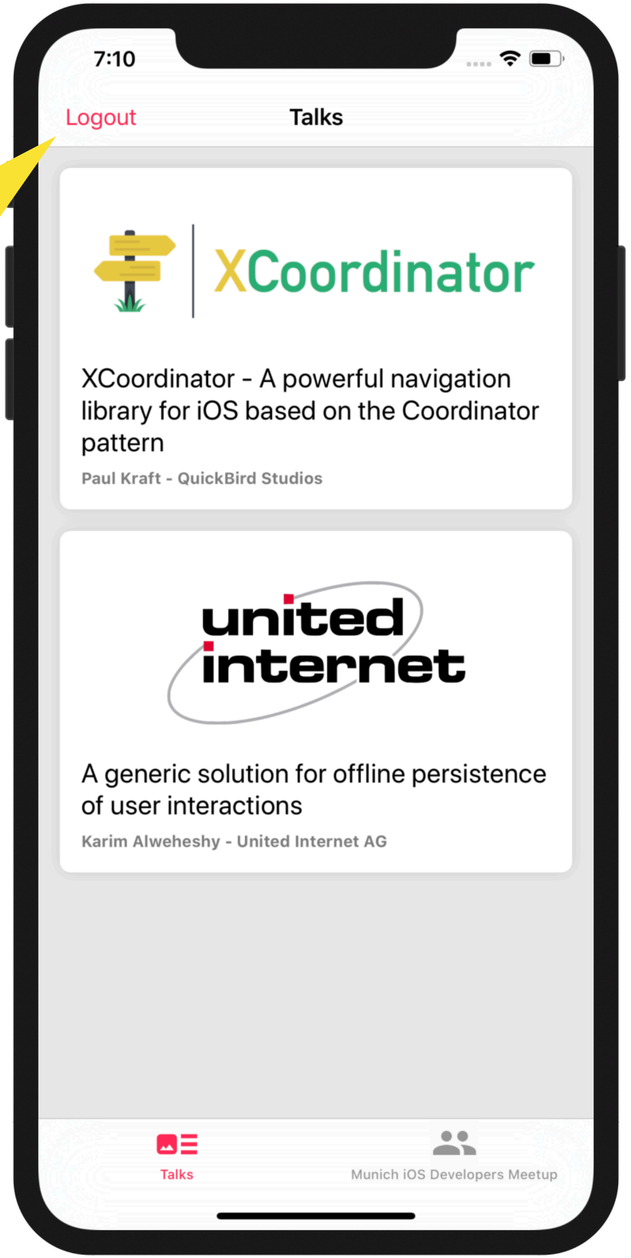


Task 2.1: 👨‍👧 Parent/Child coordinators



Task 2.1: Logout

return to “Login” screen

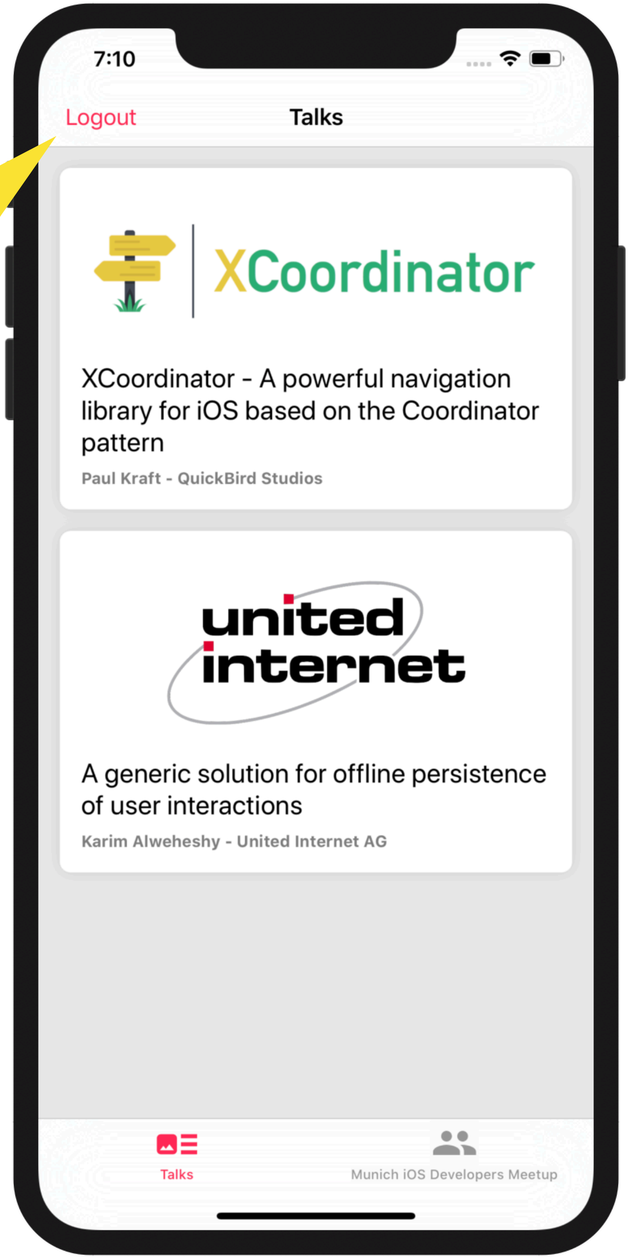


- Add UITabBarItem to TalksViewController with according action

```
private lazy var logoutButton =
    UIBarButtonItem(title: "Logout", style: .plain,
                    target: self, action: #selector(didTapLogout))

@objc private func didTapLogout() {
    router.trigger(.logout)
}
```

Task 2.1: Logout

return to “Login” screen

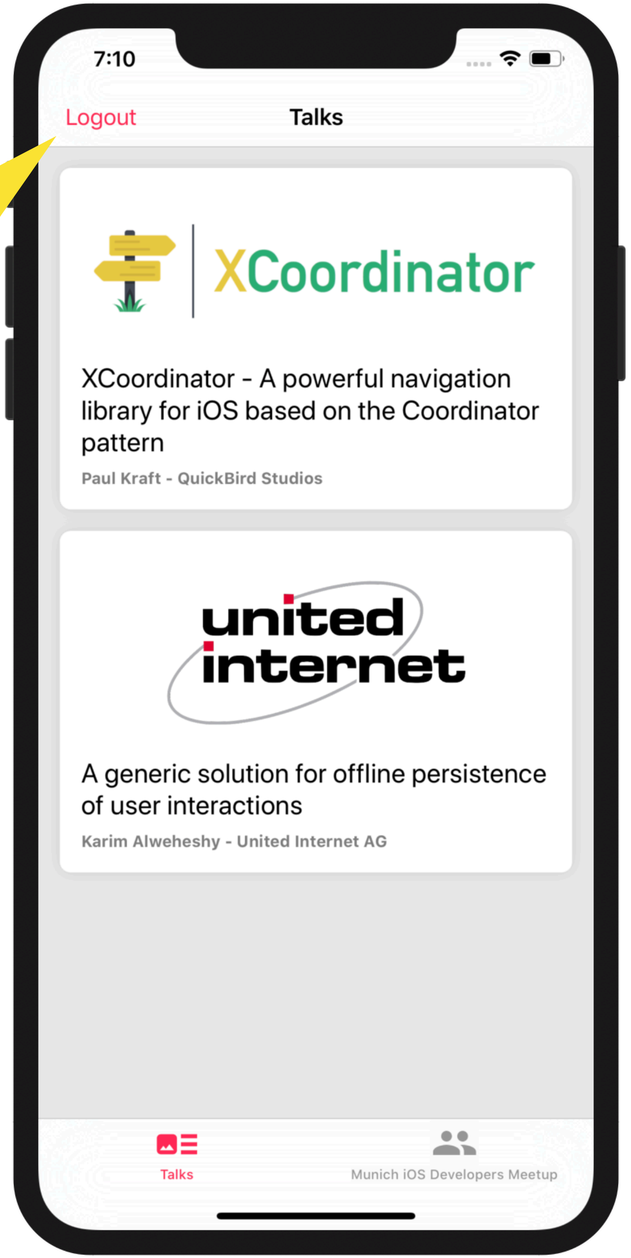


- Implement route transition in **TalksRoute.swift**

```
private let parent: UnownedRouter<HomeRoute>

init(parent: UnownedRouter<HomeRoute>) {
    self.parent = parent
    super.init(initialRoute: .initial)
}

override func prepareTransition(for route: TalksRoute
    ) -> NavigationTransition {

    switch route {
    /* … */
    case .logout:
        return .trigger(.logout, on: parent)
    }
}
```

Task 2.1: Logout

return to “Login” screen



- Implement route transition in **HomeRoute.swift**

```
private lazy var talksRouter =
    TalksCoordinator(parent: unownedRouter).strongRouter


override func prepareTransition(for route: HomeRoute
    ) -> TabBarTransition {
    switch route {
    /* … */
    case .logout:
        return .dismiss()
    }
}
```

Exercise 2: Adding more functionality

Task 1: Add “Logout” functionality using parent/child coordinators

Task 2: Open URLs using Deep Linking

Task 3: Login with reactive streams (RxSwift / Combine)

Task 2.2: 🛤 Deep Linking

- Let’s assume your app has not been started the usual way…

URL

Notification

State restoration

- How can you navigate through large parts of your app at once?

Task 2.2: Deep Linking

- We will inject the url in the SceneDelegate (it would normally be triggered by another app)

ios-meetup-munich:talk?name=XCoordinator

- The app should open with the talk visible at startup
- We will define a **LoginRoute.url(URL)** and use it as the initialRoute in the LoginCoordinator
- The LoginCoordinator already has a **talk(from:)** method to extract a talk from the url, if available.

Task 2.2: Opening URLs

- Use the predefined talk(from:) method in **LoginRoute.swift**

```
override func prepareTransition(for route: LoginRoute) -> ViewTransition {
    switch route {
    /* … */
    case .url(let url):
        guard let talk = self.talk(from: url) else {
            return deepLink(.loginSuccessful, HomeRoute.talks)
        }
        return deepLink(.loginSuccessful, HomeRoute.talks, TalksRoute.detail(talk))
    }
}
```

- When using deep linking, make sure to include transitions to all coordinators along the coordinator hierarchy, since otherwise, the deep link will fail at runtime.

Exercise 2: Adding more functionality

Task 1: Add “Logout” functionality using parent/child coordinators

Task 2: Open URLs using Deep Linking

Task 3: Login with reactive streams (RxSwift / Combine)

Task 2.3: 🚀 Reactive extensions

- **trigger** completion block informs about completed transitions
- **trigger** reactive extension returns Observable/Publisher
- Useful for triggering routes after certain reactive event happened (e.g. login)
- Useful for executing code after transition has completed

Regular:
```
router.trigger(.loginSuccessful, completion: { /* done */ })
```

RxSwift:
```
router.rx.trigger(.loginSuccessful) // Observable<Void>
```

Combine:
```
router.publishers.trigger(.loginSuccessful) // Future<Void, Never>
```

Task 2.3: Reactive extensions (RxSwift)

- API:

```
router.rx.trigger(<some route>)
```

- Example:

```
let loginObservable = login() // Observable<LoginData>
    .flatMap { [unowned self] loginData in
        self.router.rx.trigger(.loginSuccess(loginData))
    }
    .catchError { [unowned self] error in
        self.router.rx.trigger(.loginFailure(error))
    }
```

Task 2.3: Reactive extensions (Combine)

- API:

```
router.publishers.trigger(<some route>)
```

- Example:

```
let loginPublisher = login() // AnyPublisher<LoginData, Error>
    .flatMap { [unowned self] in
        self.router.publishers
            .trigger(.loginSuccessful)
            .mapError { _ -> Error in }
    }
    .catch { [unowned self] _ in
        self.router.publishers.trigger(.loginFailed)
    }
```

XCoordinator

QUICKBIRD STUDIOS

- Powerful navigation library for iOS using the **Coordinator pattern**
- Developed by **QuickBird Studios**, located in Munich
- Provides **base classes for different coordinator types**, such as **NavigationCoordinator, TabBarCoordinator,** and many more
- **Encapsulates navigation code** for UIKit and provides **consistent API for different transition types**
- **Predefined transition types** with completion handler to ensure that transitions are executed sequentially
- **RxSwift** & **Combine** extensions!
- Full support for **custom transitions & animations**

References

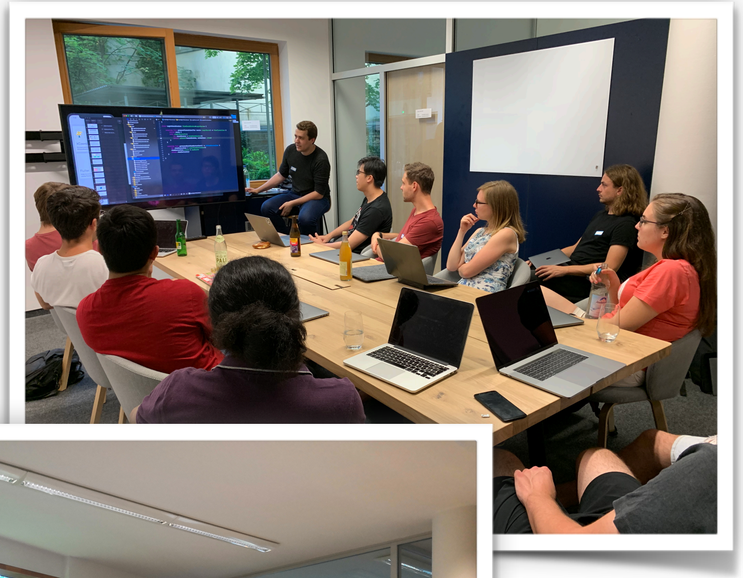
- **XCoordinator**: Powerful navigation library for iOS based on the coordinator pattern (https://github.com/quickbirdstudios/XCoordinator)

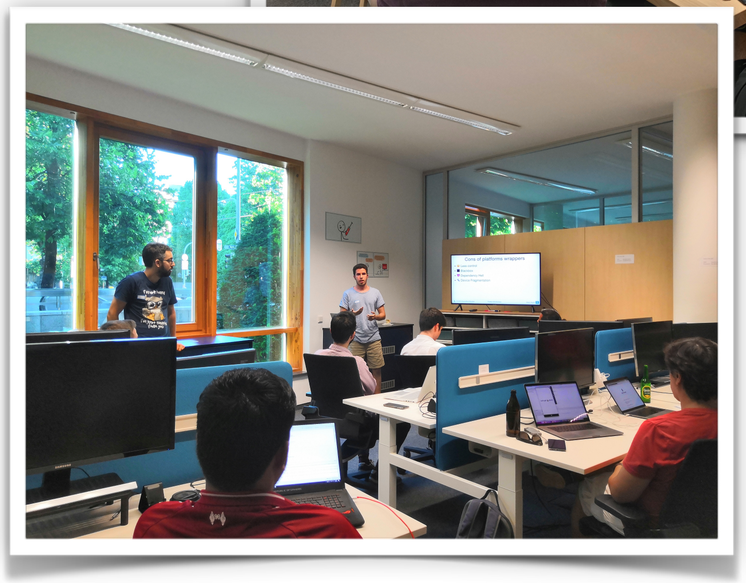
- **Introducing an iOS navigation library based on the coordinator pattern** by Stefan Kofler (https://quickbirdstudios.com/blog/ios-navigation-library-based-on-the-coordinator-pattern)

- **The Coordinator** by Soroush Khanlou (http://khanlou.com/2015/01/the-coordinator)

Mobile Hack Night @ QuickBird Studios

- 2 exciting workshops (at the same time):
  - SwiftUI: Get hands-on experience with Apple's newest UI framework for building iOS Apps
  - Mastering Gradle - How to tame the beast with buildSrc
- Presentation, Live Coding, Hacking, Socializing & Food!
- Tue, 5 November 2019 at 6:45 PM - 9:00 PM
- Location:
  - QuickBird Studios
  - Nymphenburger Str. 13-15
  - 80335 München
- Register here: bit.ly/mobileHack





App Advice

- You have questions about your app's architecture, mobile technologies or code style?
- 30 Minutes of free personal development advice from our experienced software engineers
- You can ask us about code snippets, scribble things on a blackboard and ask us many questions!
- Submit your request here: bit.ly/appAdvice30

QuickBird Studios

- **Mobile HackNight**
  - November 5, 6:45 PM - 9 PM, Nymphenburger Str. 13-15
  - Presentation + Live Coding + Hacking + Socializing + Food!
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