

移动平台开发技术

iOS应用的数据模式与SwiftUI和UIKit交互

章国锋 2025春夏学期

SwiftUI中的属性包装器

SwiftUI中的数据模式

SwiftUI与UIKit交互

SwiftUI中的属性包装器

SwiftUI中的数据模式

SwiftUI与UIKit交互

SwiftUI中的属性包装器

Property wrappers in SwiftUI



数据流属性包装器

Property wrappers for data flow

交互响应属性包装器

Property wrappers for interaction

数据持久化属性包装器

Property wrappers for data persistent

SwiftUI中的属性包装器

Property wrappers in SwiftUI



数据流属性包装器

Property wrappers for data flow

@State & @Binding

@StateObject & @ObservedObject & @EnvironmentObject

@Environment

SwiftUI中的属性包装器

Property wrappers in SwiftUI



数据流属性包装器

Property wrappers for data flow

@State & @Binding

- 当需要因视图内的数据变化而触发视图更新时, **@State** 是理想的选择。
- 它常用于简单的 UI 组件状态管理, 如开关状态、文本输入等。
- 如果数据不需要复杂的跨视图共享, 使用 **@State**可以简化状态管理。
- **@Binding** 不直接持有数据, 而是提供了对其他数据源的读写访问的包装
- 它允许 UI 元素直接修改数据, 并反映这些数据的变化

SwiftUI中的属性包装器

Property wrappers in SwiftUI



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Property wrappers for data flow

@StateObject & @ObservedObject & @EnvironmentObject

- **@StateObject** 专门用于管理符合 **ObservableObject** 协议的实例。
- 标注的对象实例在视图的整个生命周期中保持唯一，即使视图更新，对象实例也不会重新创建。
- 相较 **@State** 而言，**@StateObject** 更适合管理复杂的数据模型及其执行逻辑
- **@ObservedObject** 不持有被观察的实例，不保证其生存期
- 使用 **@EnvironmentObject** 前，必须确保已在视图层级的上游提供了相应的实例（通过 **.environmentObject** 修饰器），否则将导致运行时错误。
- 它对视图的更新触发条件与 **@StateObject** 和 **@ObservedObject** 一样。

SwiftUI中的属性包装器

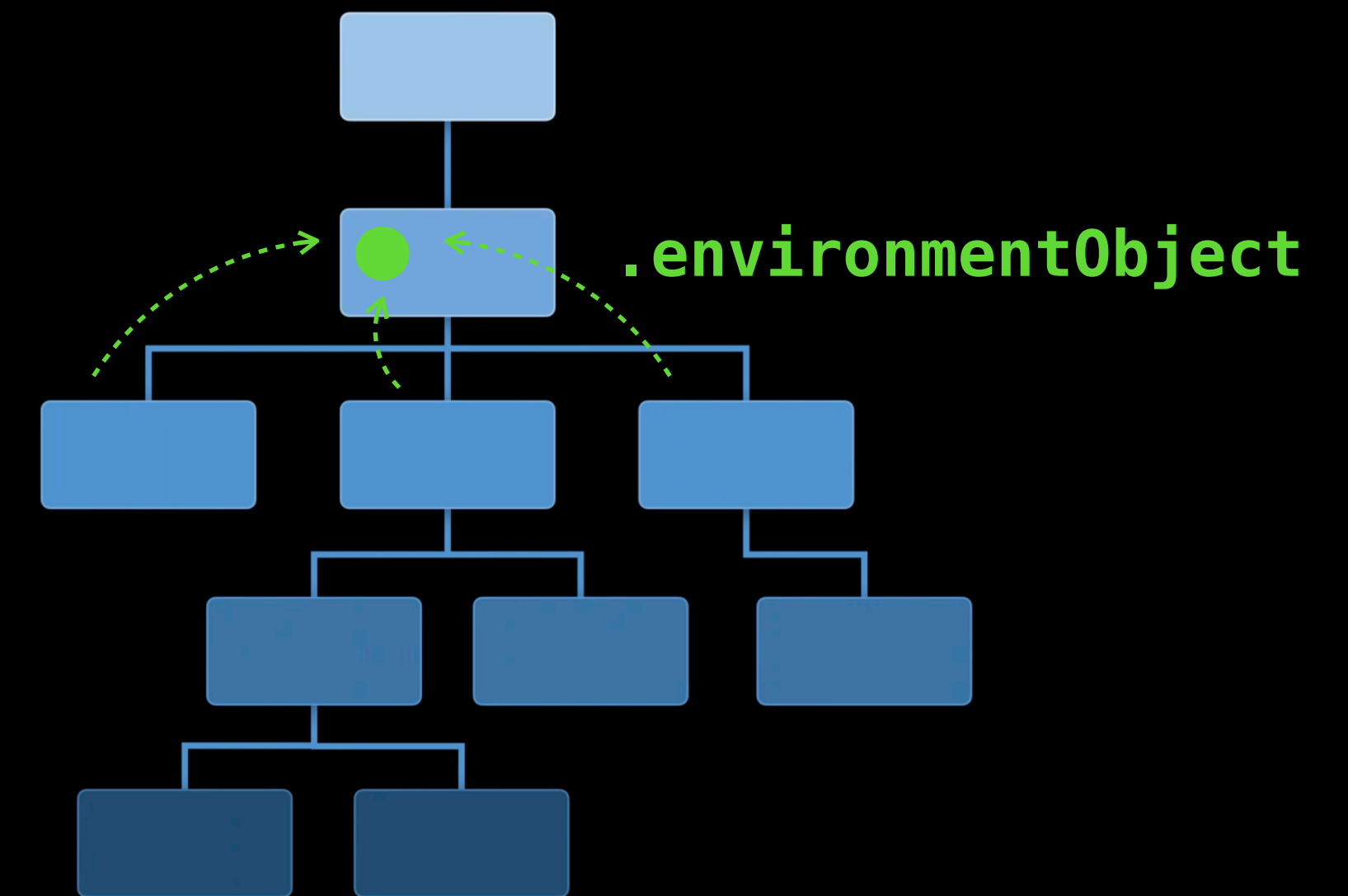
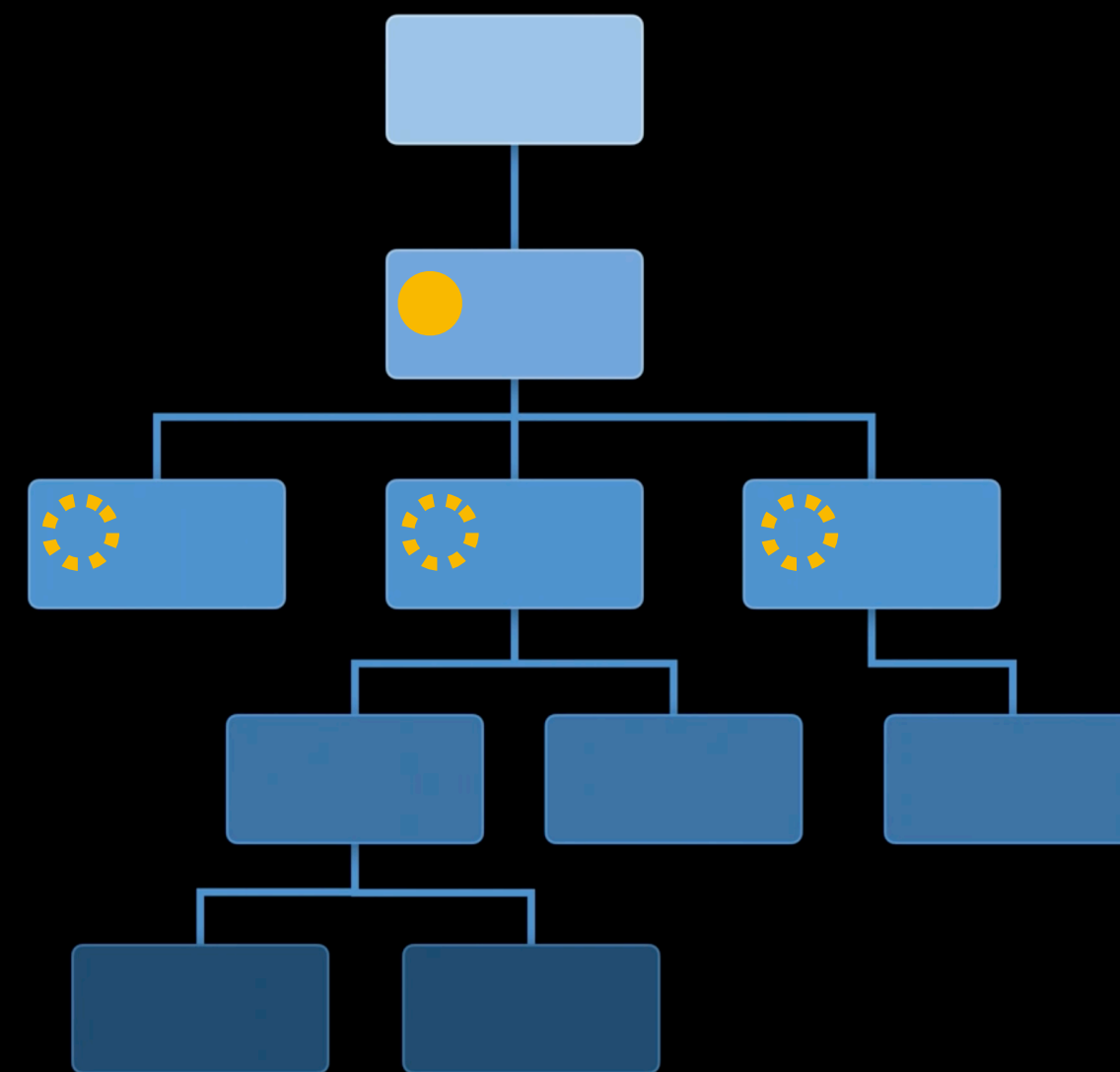
Property wrappers in SwiftUI



数据流属性包装器

Property wrappers for data flow

`@StateObject` & `@ObservedObject` & `@EnvironmentObject`



SwiftUI中的属性包装器

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数据流属性包装器

Property wrappers for data flow

- 当需要访问和响应如界面样式（暗模式/亮模式）、设备方向、字体大小等由系统或上层视图提供的环境值时（通常对应值类型）
- 当需要访问和调用 SwiftData 的 ModelContext 时（对应引用类型）
- 当需要使用系统提供的一些方法时，比如 **dismiss**、**openURL**（通过 struct 的 **callAsFunction** 封装的方法）

```
@Environment(\.presentationMode) var presentationMode
```

- 在 **Observation** 框架的背景下，**@State** 和 **@Environment** 成为了最主要的属性包装器

@Environment

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`@State` & `@Binding`

`@StateObject` & `@ObservedObject` & `@EnvironmentObject`

`@Environment`

`@StateObject`、`@ObservedObject` 和 `@EnvironmentObject` 专用于关联符合 `ObservableObject` 协议的实例。

`@StateObject` 通常用于创建和维护实例，而 `@ObservedObject` 用于引入和响应已存在的实例，`@EnvironmentObject` 适用于在多视图中数据传递

在 iOS 17+ 的环境中，如果应用主要依赖于 `Observation` 和 `SwiftData` 框架，那么这三个属性包装器的使用频率可能会相对较低

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交互响应属性包装器

Property wrappers for interaction

@FocusState

@GestureState

@ScaledMetric

@Namespace

SwiftUI中的属性包装器

Property wrappers in SwiftUI



交互响应属性包装器

Property wrappers for interaction

@FocusState

- 主要用于管理和追踪用户界面中的焦点状态
- 目前，只有 `TextField` 和 `TextEditor` 支持通过代码修改 `@FocusState` 的值来获得或失去焦点

SwiftUI中的属性包装器

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交互响应属性包装器

Property wrappers for interaction

@GestureState

- 临时存储与手势相关的状态
- 让手势处理代码更加简洁，且易于维护

SwiftUI中的属性包装器

Property wrappers in SwiftUI



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Property wrappers for interaction

@ScaledMetric

- 主要用于根据用户的辅助功能设置（如更大的文本大小）自动调整数值
- 它能够确保应用界面在不同用户偏好下保持可用性和舒适性
- 可以用于调整任何需要根据系统字体大小比例变化的尺寸，如图标大小、布局间距等。
- 使用 `.dynamicTypeSize` 限制视图的动态类型尺寸变化范围，防止布局异常

SwiftUI中的属性包装器

Property wrappers in SwiftUI



交互响应属性包装器

Property wrappers for interaction

- 通常应用于传递到其他视图中进行animation使用
- @Namespace 不仅限于与 matchedGeometryEffect 搭配使用，还可以用于其他元素或视图修饰器，如 accessibilityRotorEntry、AccessibilityRotorEntry、accessibilityLinkedGroup、prefersDefaultFocus 和 defaultFocus

@Namespace

SwiftUI中的属性包装器

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@FocusState

@GestureState

@ScaledMetric

@Namespace

@FocusState 简化了焦点管理； @GestureState 自动化手势状态的生命周期；
@ScaledMetric 实现了尺寸的自动缩放； @Namespace 充当标识符的角色；

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数据持久化属性包装器

Property wrappers for data persistent

@AppStorage & @SceneStorage

@FetchRequest & @SectionedFetchRequest & @Query

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数据持久化属性包装器

Property wrappers for data persistent

@AppStorage & @SceneStorage

- 通过 UserDefaults, **@AppStorage** 实现了数据的持久存储, 确保即便应用关闭后, 数据依然得以保存
- UserDefaults 的持久化不是原子级别的, 存在数据丢失的风险
- 不建议用来保存关键或敏感数据
- 默认仅支持有限的数据类型。常见的数据类型如日期和数组等默认不被支持
- **@SceneStorage** 是一个专属于 SwiftUI 的独特概念, 它并不对应任何已知的底层数据结构。因此, **@SceneStorage** 应仅在视图内部使用, 不应在视图外部或视图模型中使用它

```
@SceneStorage("selectedTab") private var selectedTab: Int = 0
@appStorage("isLoggedIn") var isLoggedIn: Bool = false
```


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SwiftUI与UIKit交互

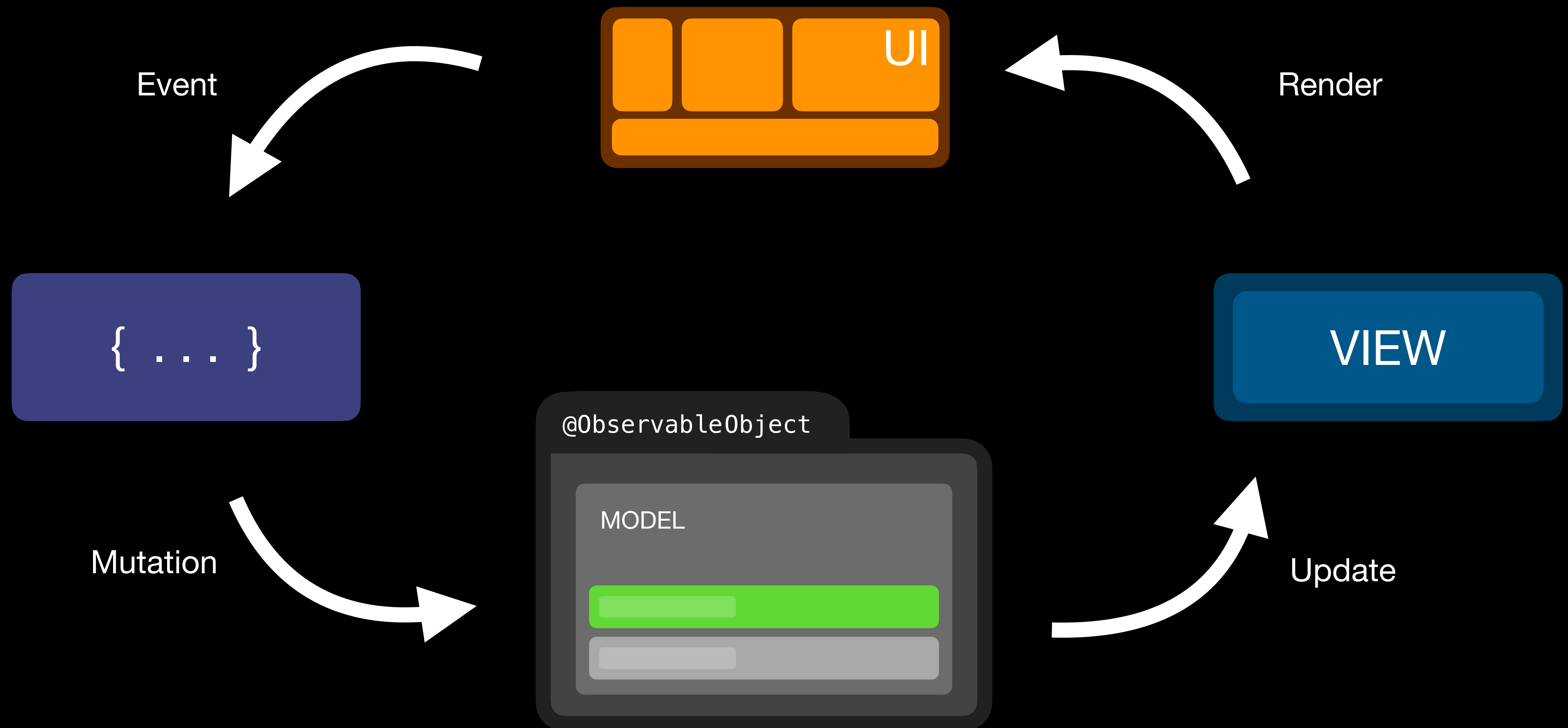
SwiftUI中的属性包装器

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SwiftUI中的数据模式

Model-View-ViewModel architecture in SwiftUI

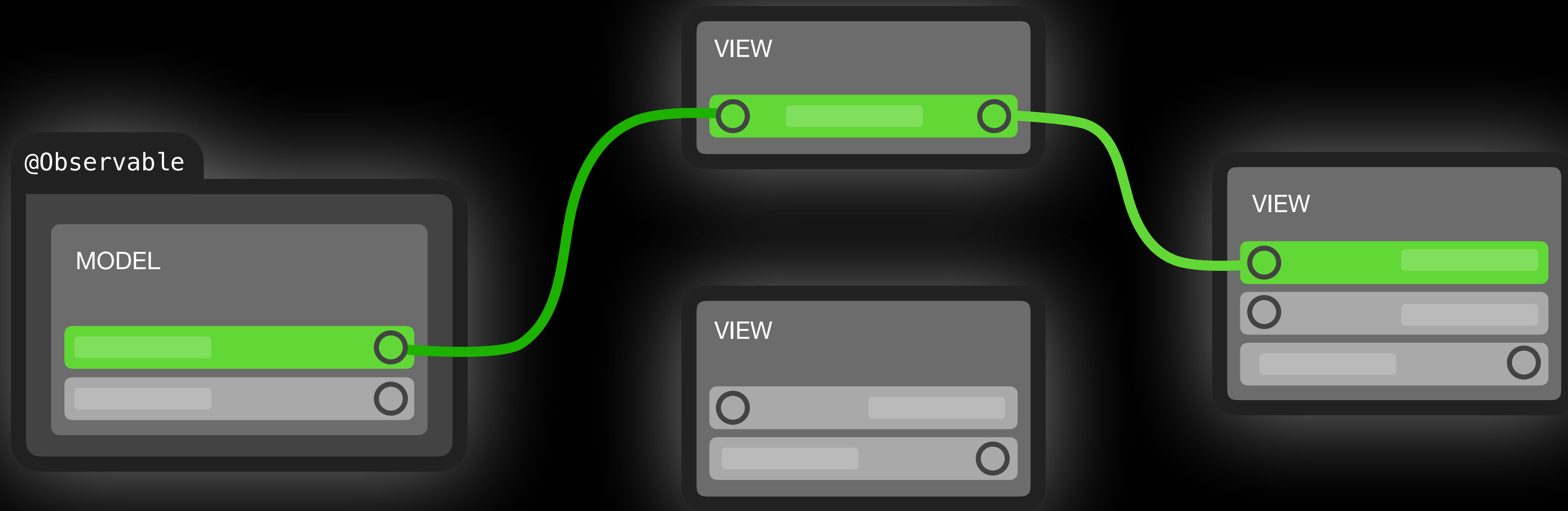


SwiftUI中的数据模式

Model-View-ViewModel architecture in SwiftUI



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UIKit

View controllers

Interface Builder and storyboards

Delegates and data sources

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Interfacing with UIKit

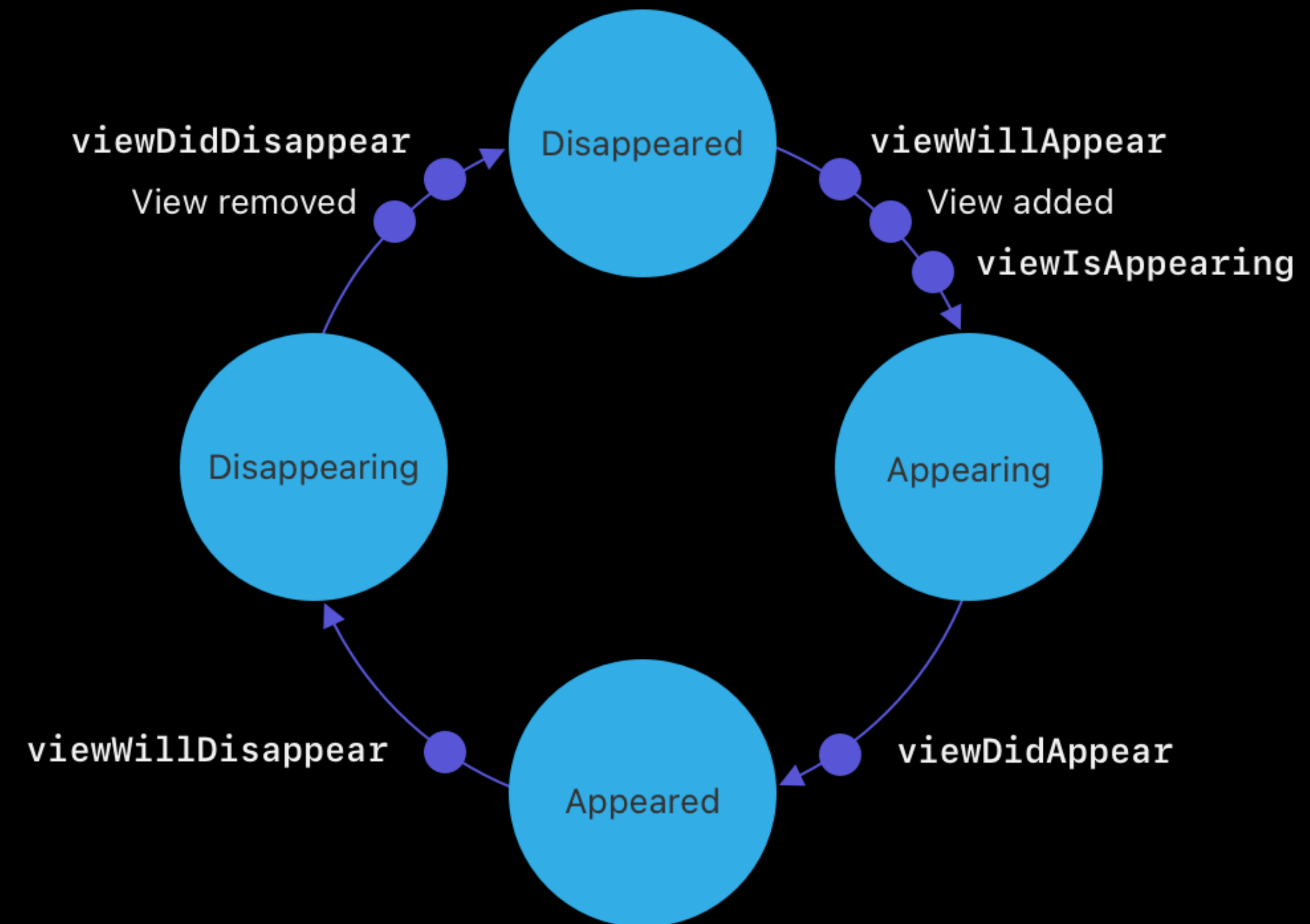


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View controllers



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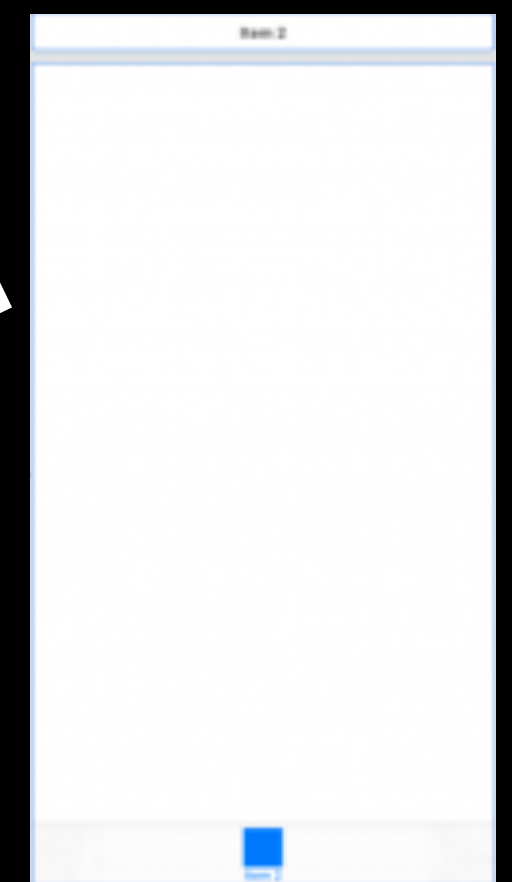
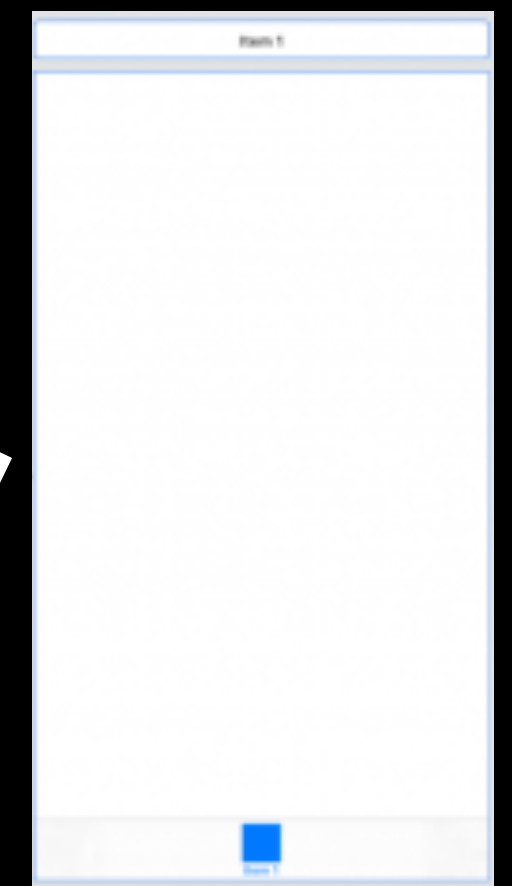
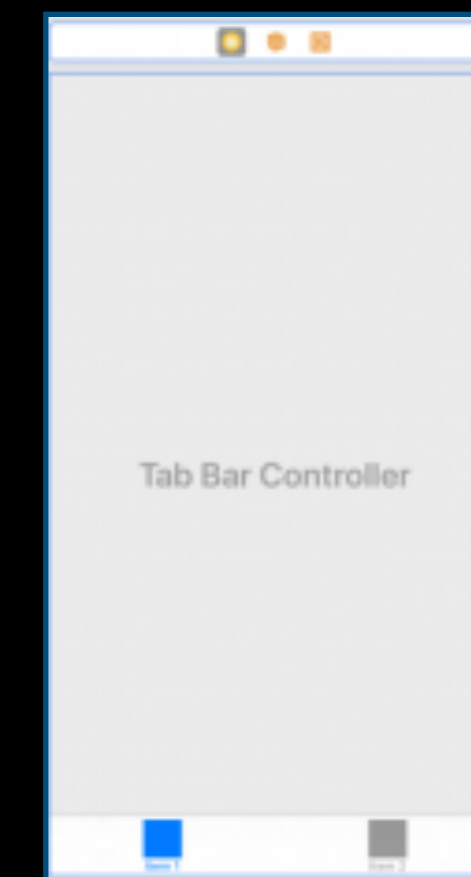
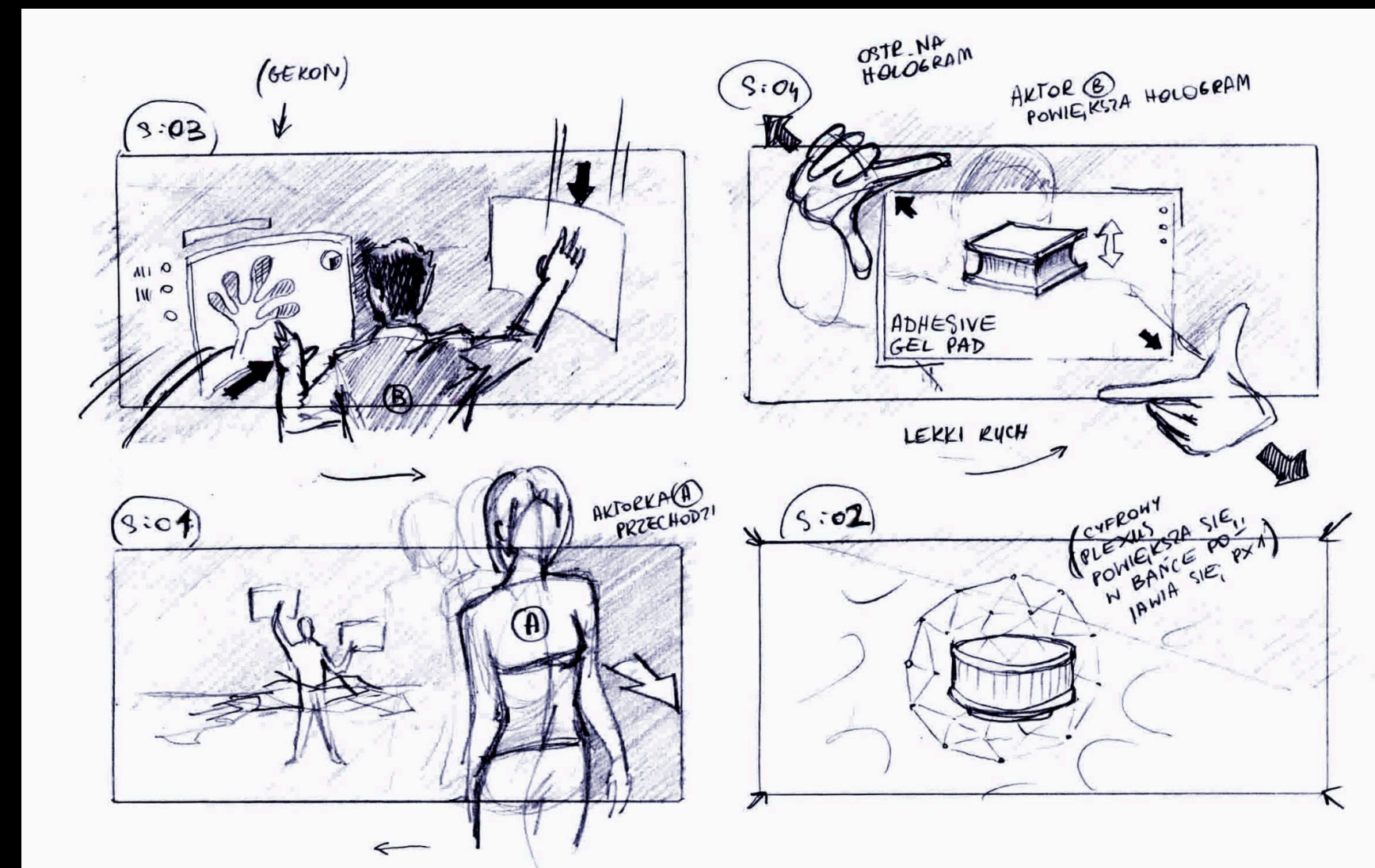


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Interface Builder and storyboards



UIKit



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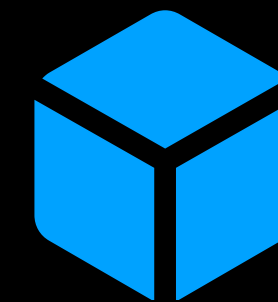
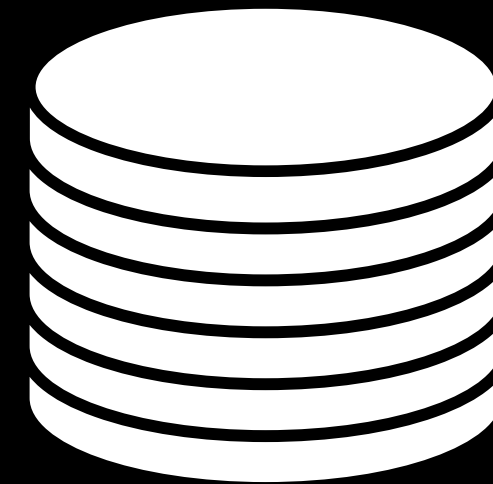
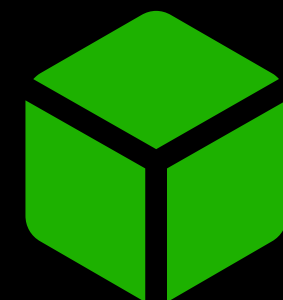


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Delegates and data sources



UIKit



SwiftUI与UIKit交互

Interfacing with UIKit



1. 考虑 iOS 版本的兼容性

Target iOS version and device compatibility

UIKit 支持 iOS 9 及之后的所有版本,
SwiftUI只支持 iOS 13 及之后的版本

iPhone



76% of all devices introduced in the last four years use iOS 17.

76%

iOS 17

- 76% iOS 17
- 20% iOS 16
- 4% Earlier

66% of all devices use iOS 17.

66%

iOS 17

- 66% iOS 17
- 23% iOS 16
- 11% Earlier

iPad



61% of all devices introduced in the last four years use iPadOS 17.

61%

iPadOS 17

- 61% iPadOS 17
- 29% iPadOS 16
- 10% Earlier

53% of all devices use iPadOS 17.

53%

iPadOS 17

- 53% iPadOS 17
- 29% iPadOS 16
- 18% Earlier

SwiftUI与UIKit交互

Interfacing with UIKit



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1. 考虑 iOS 版本的兼容性

Target iOS version and device compatibility

UIKit 支持 iOS 9 及之后的所有版本，SwiftUI只支持 iOS 13 及之后的版本

2. 项目复杂性和团队经验

Project complexity and team experience

UIKit 是成熟的框架，但是学习难度较大，SwiftUI易上手，但是还在更新迭代

SwiftUI与UIKit交互

Interfacing with UIKit



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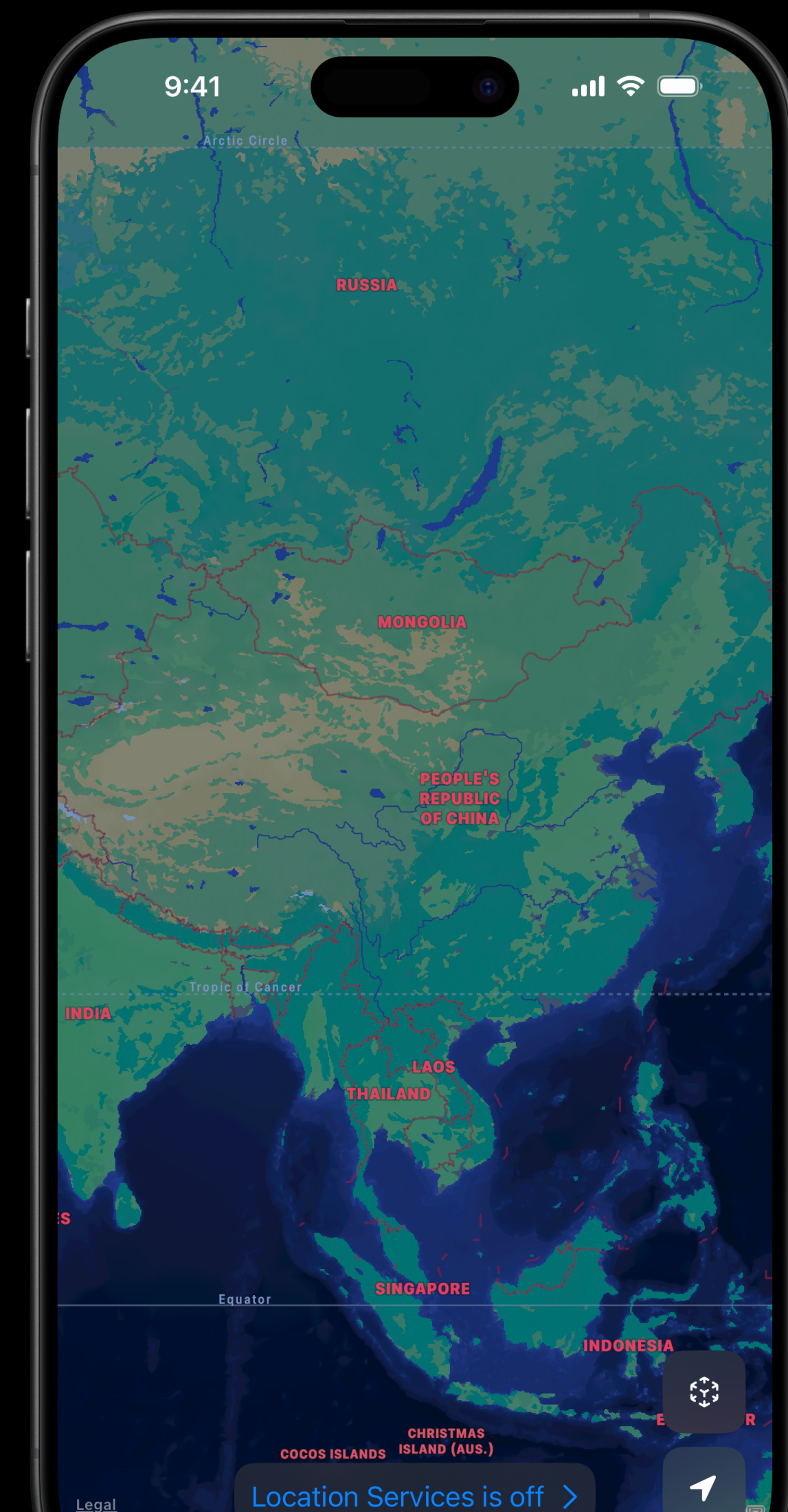
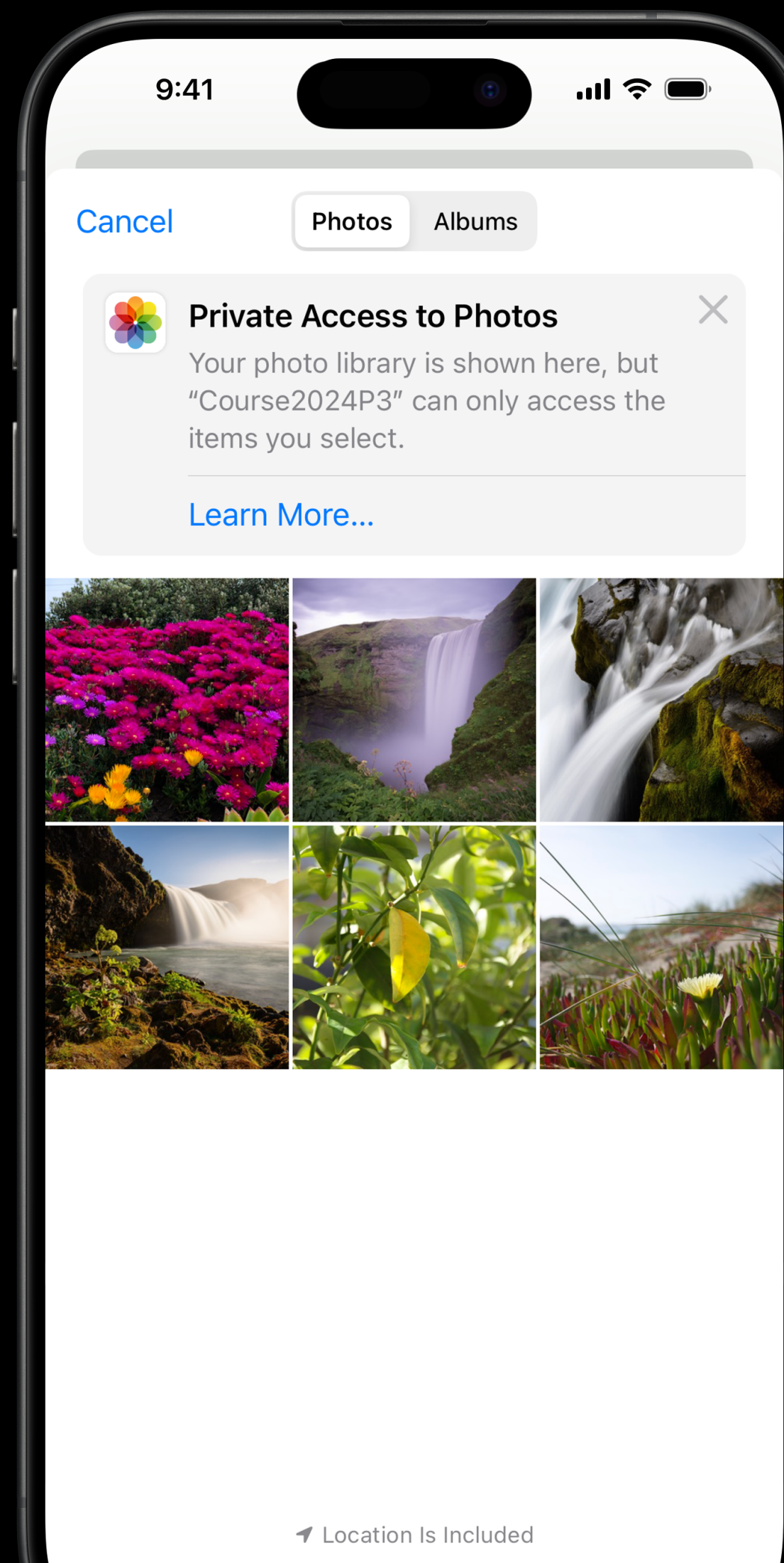
3. 项目所需的UI 组件和设计模式

Required UI components and design patterns

UIKit 具有大量 UI 组件（包括部分在SwiftUI上没有对应的组件），但在 SwiftUI 中可以使用 UIKit 的组件

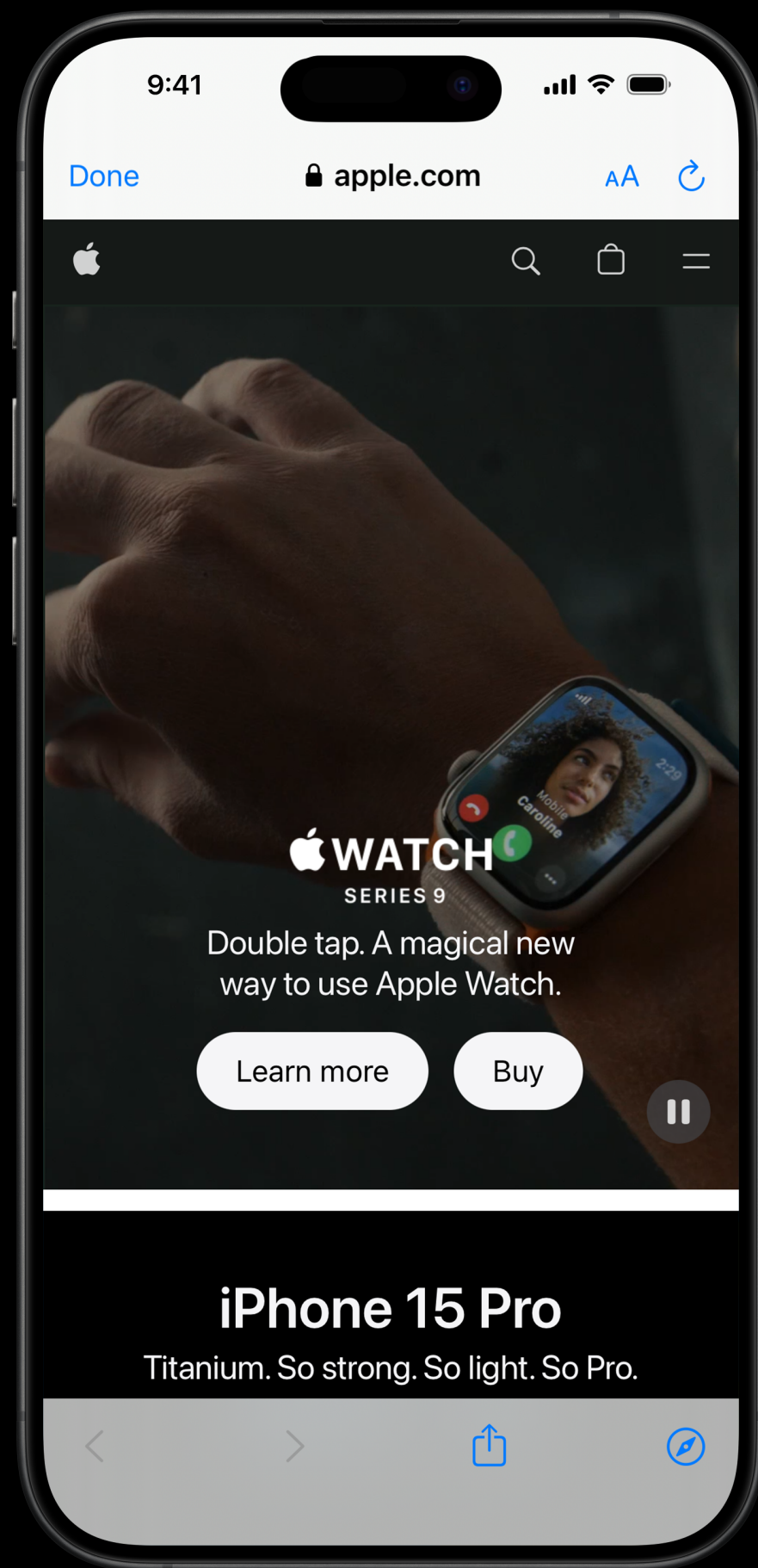
SwiftUI与UIKit交互

Interfacing with UIKit



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Interfacing with UIKit



SFSafariViewController

iOS 9.0+

iPadOS 9.0+

Mac Catalyst 13.1+

visionOS 1.0+

iOS应用的数据模式与SwiftUI和UIKit交互

SwiftUI与UIKit交互

Interfacing with UIKit



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SFSafariViewController

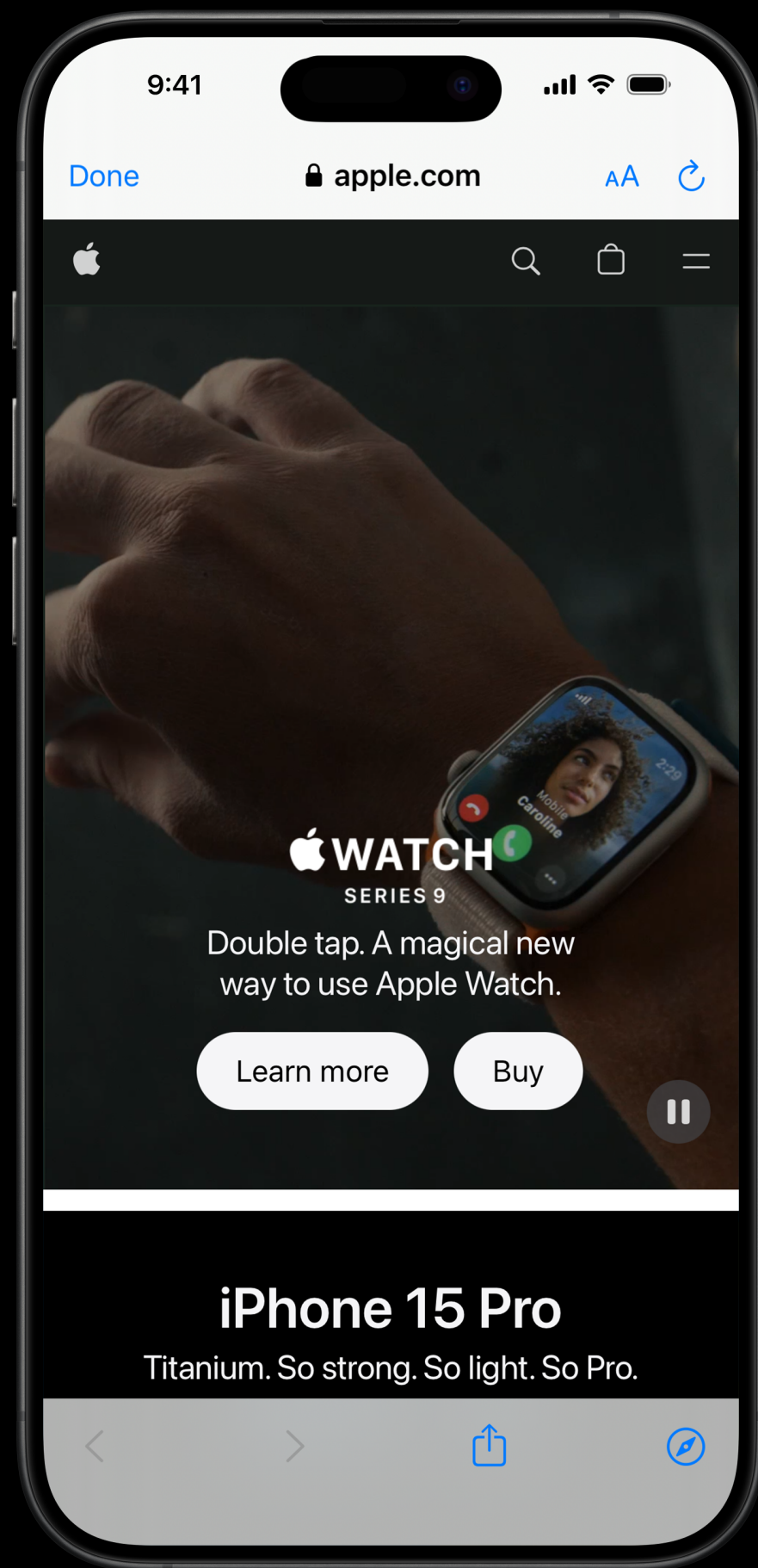
Representable



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```
struct SFSafariViewControllerWrapper: UIViewControllerRepresentable {  
  
}
```



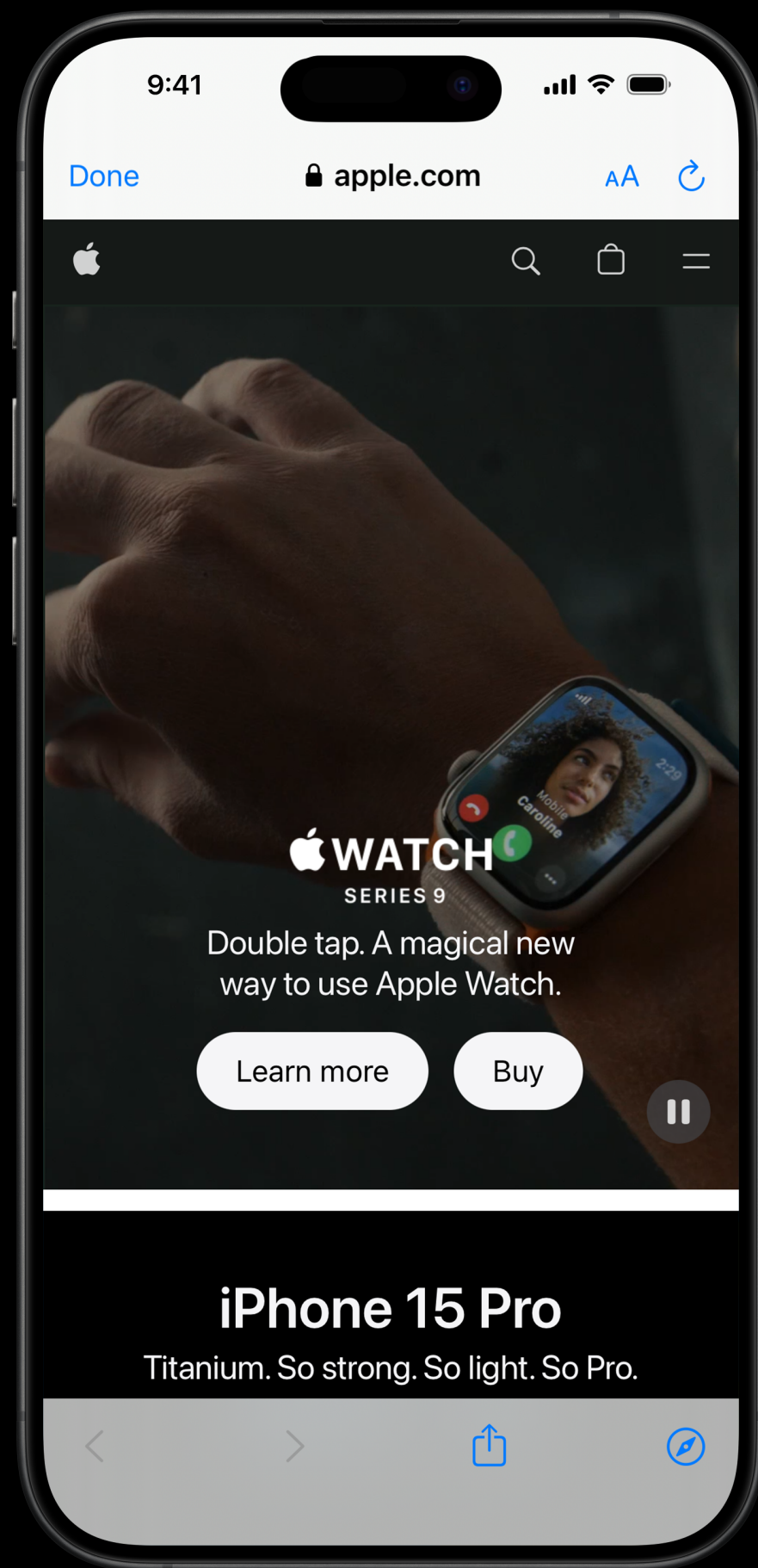
Type 'SFSafariViewControllerWrapper' does not conform to protocol 'UIViewControllerRepresentable'

Do you want to add protocol stubs?

Fix it

SwiftUI与UIKit交互

Interfacing with UIKit



```
struct SFSafariViewControllerWrapper: UIViewControllerRepresentable {  
  
    typealias UIViewControllerType = type  
  
}
```

SwiftUI与UIKit交互

Interfacing with UIKit



```
struct SFSafariViewControllerWrapper: UIViewControllerRepresentable {  
  
    typealias UIViewControllerType = SFSafariViewController  
  
}
```

2 ✖

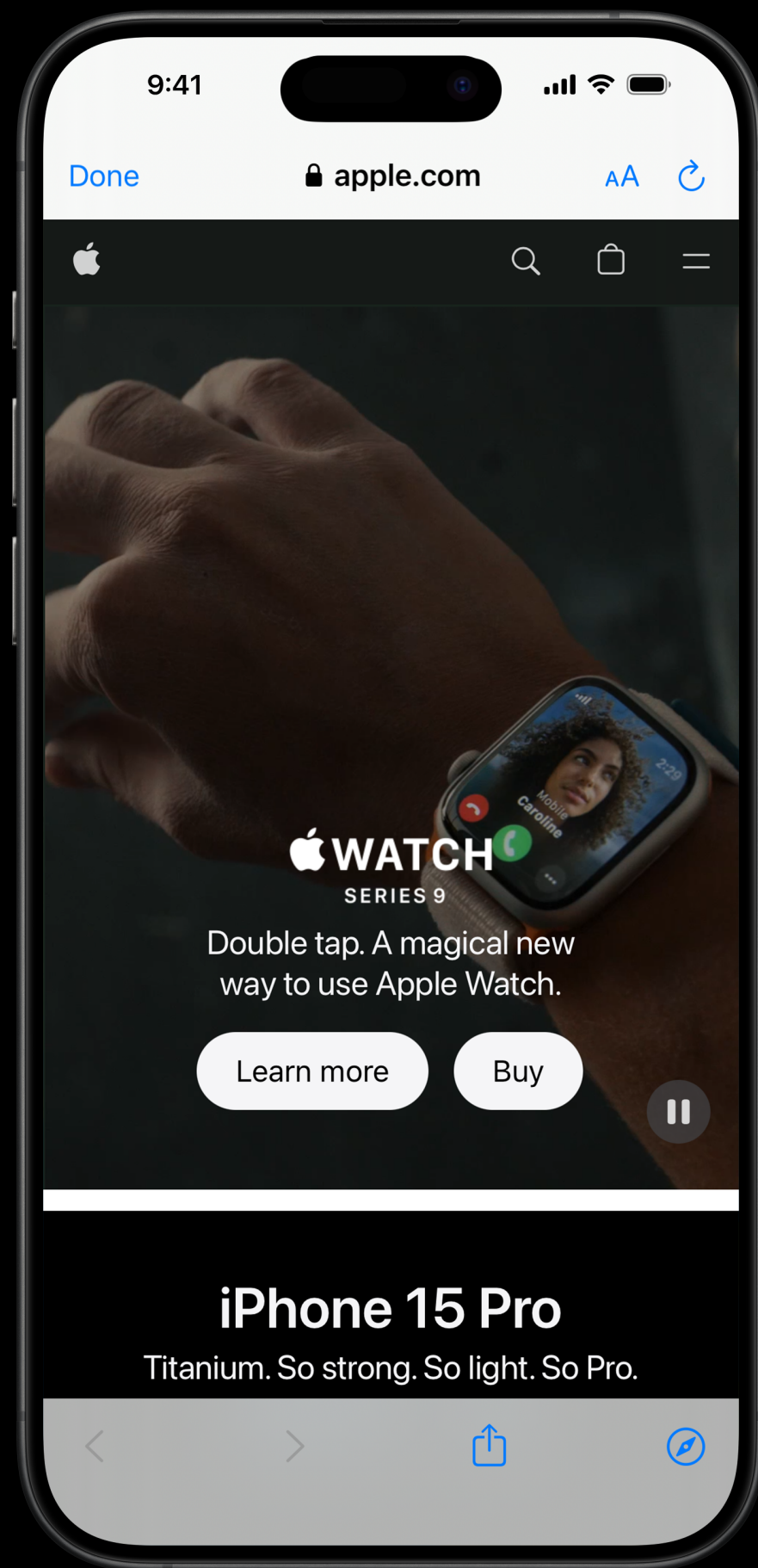
Type 'SFSafariViewControllerWrapper' does not conform to protocol 'UIViewControllerRepresentable'

Do you want to add protocol stubs?

Fix it

SwiftUI与UIKit交互

Interfacing with UIKit



```
struct SFSafariViewControllerWrapper: UIViewControllerRepresentable {  
  
    typealias UIViewControllerType = SFSafariViewController  
  
    func makeUIViewController(context: Context)  
        -> SFSafariViewController {  
    }  
  
    func updateUIViewController(_ uiViewController: SFSafariViewController,  
                                context: Context) {  
    }  
}
```

SwiftUI与UIKit交互

Interfacing with UIKit



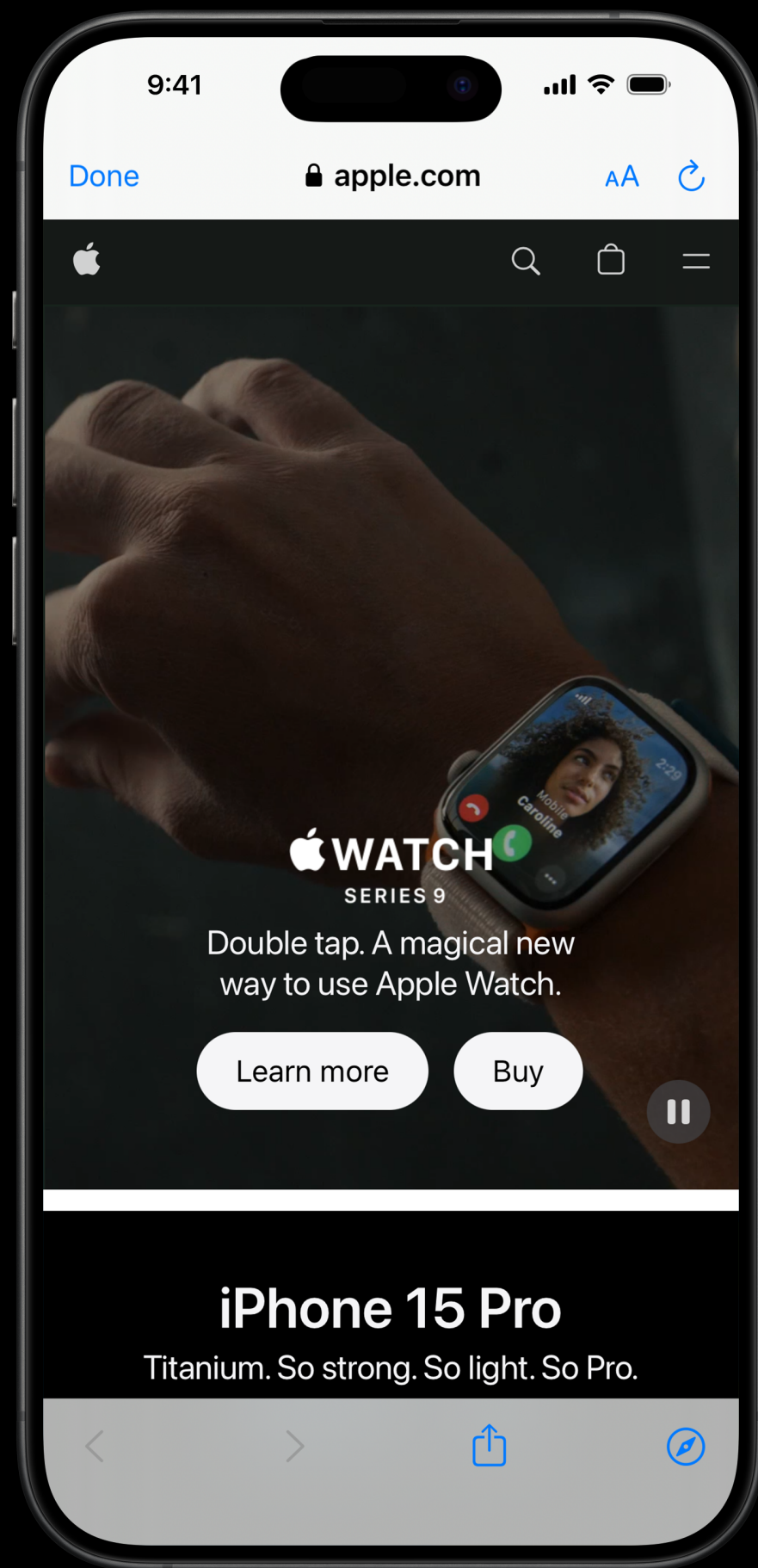
```
struct SFSafariViewControllerWrapper: UIViewControllerRepresentable {  
  
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    }  
  
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    }  
  
}
```

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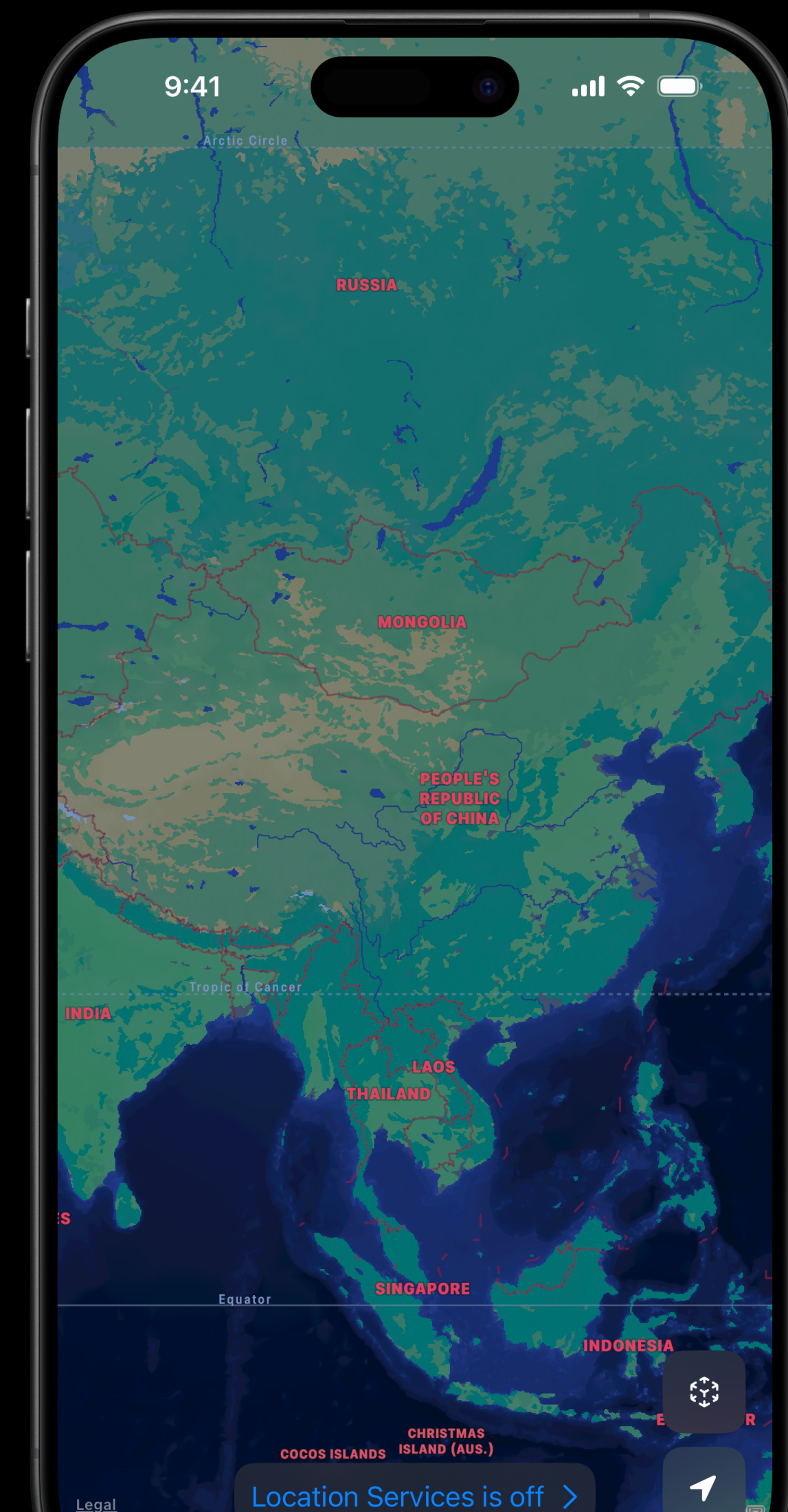
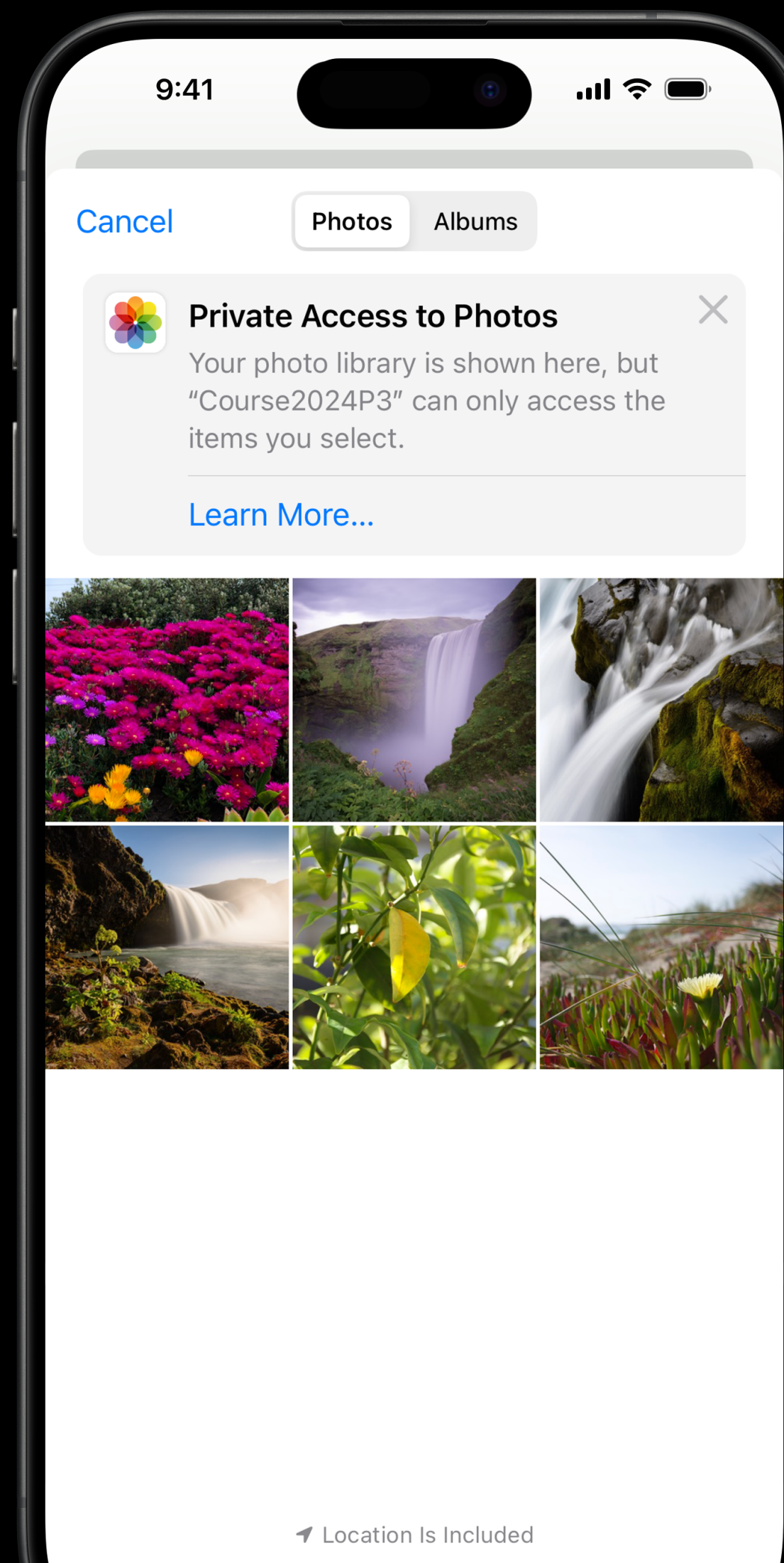


```
let url: URL
```

```
return SFSafariViewController(url: url)
```


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Interfacing with UIKit

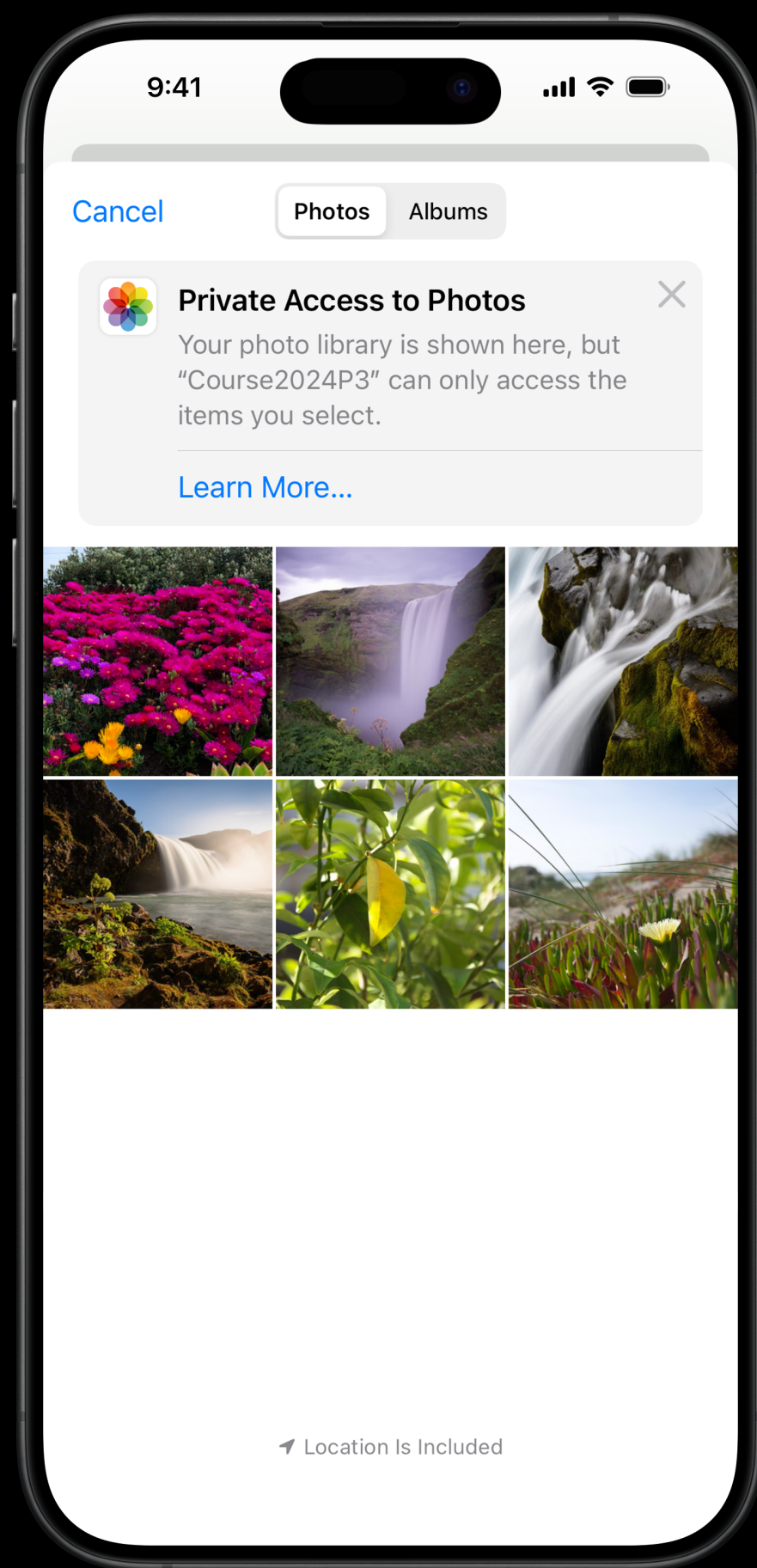


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Interfacing with UIKit



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Joint **P**hotographic **E**xperts **G**roup

- standard image format
- containing lossy and compressed image data
- compressed but maintain reasonable image quality still



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Interfacing with UIKit



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Portable **N**etwork **G**raphic

- raster image file.
- can handle graphics with transparent backgrounds.



SwiftUI与UIKit交互

Interfacing with UIKit



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High **E**fficiency **I**mage **F**ormat

- a modern photo file type
- similar quality to a JPEG but take less space.

SwiftUI与UIKit交互

Interfacing with UIKit



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High **E**fficiency **I**mage **C**ontainer

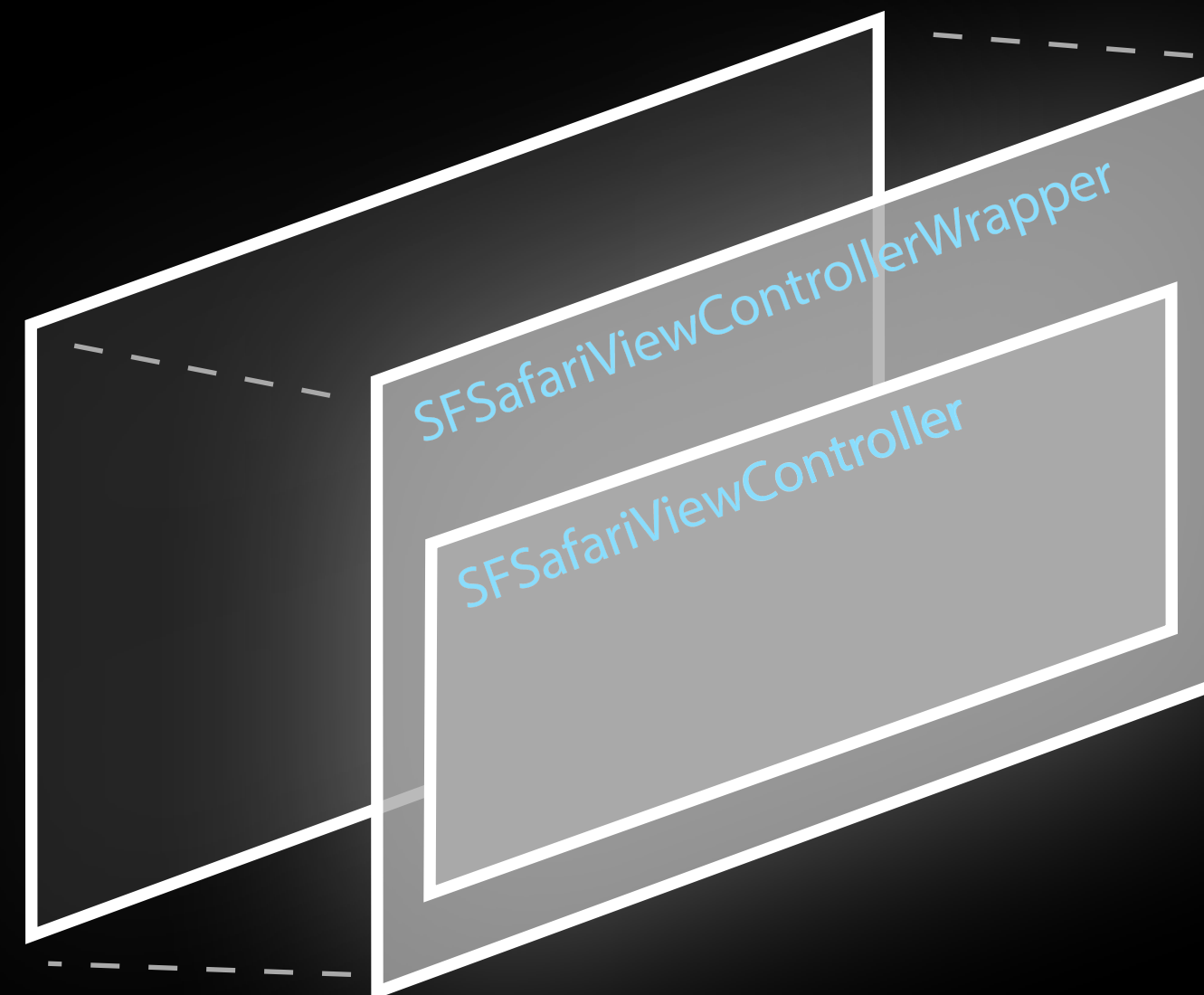
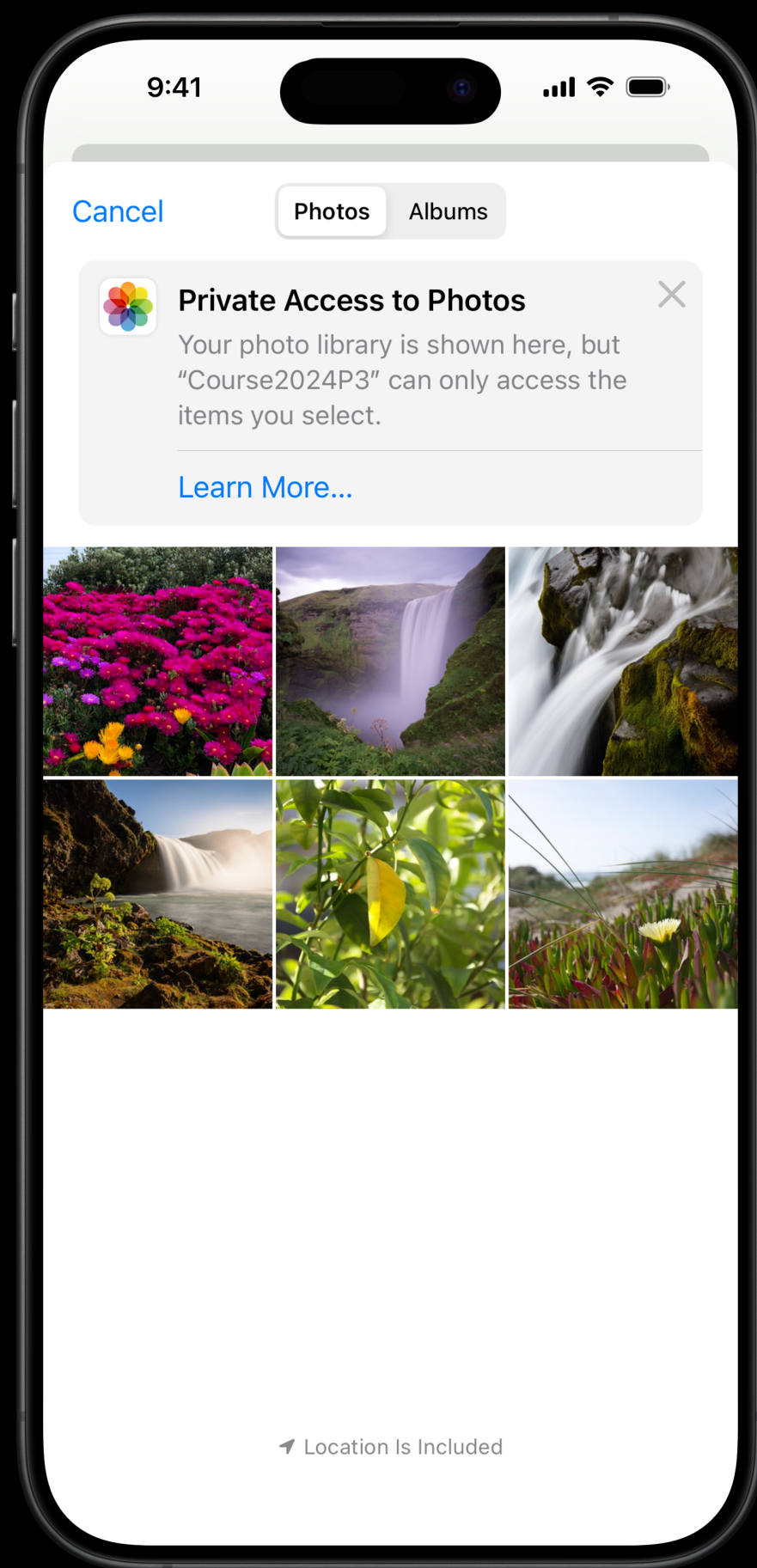
- It is Apple's proprietary version of the HEIF
- smaller while retaining high quality.
- store the HEIF photo as well as additional data
like sounds or motion when recording in a live photo.

SwiftUI与UIKit交互

Interfacing with UIKit



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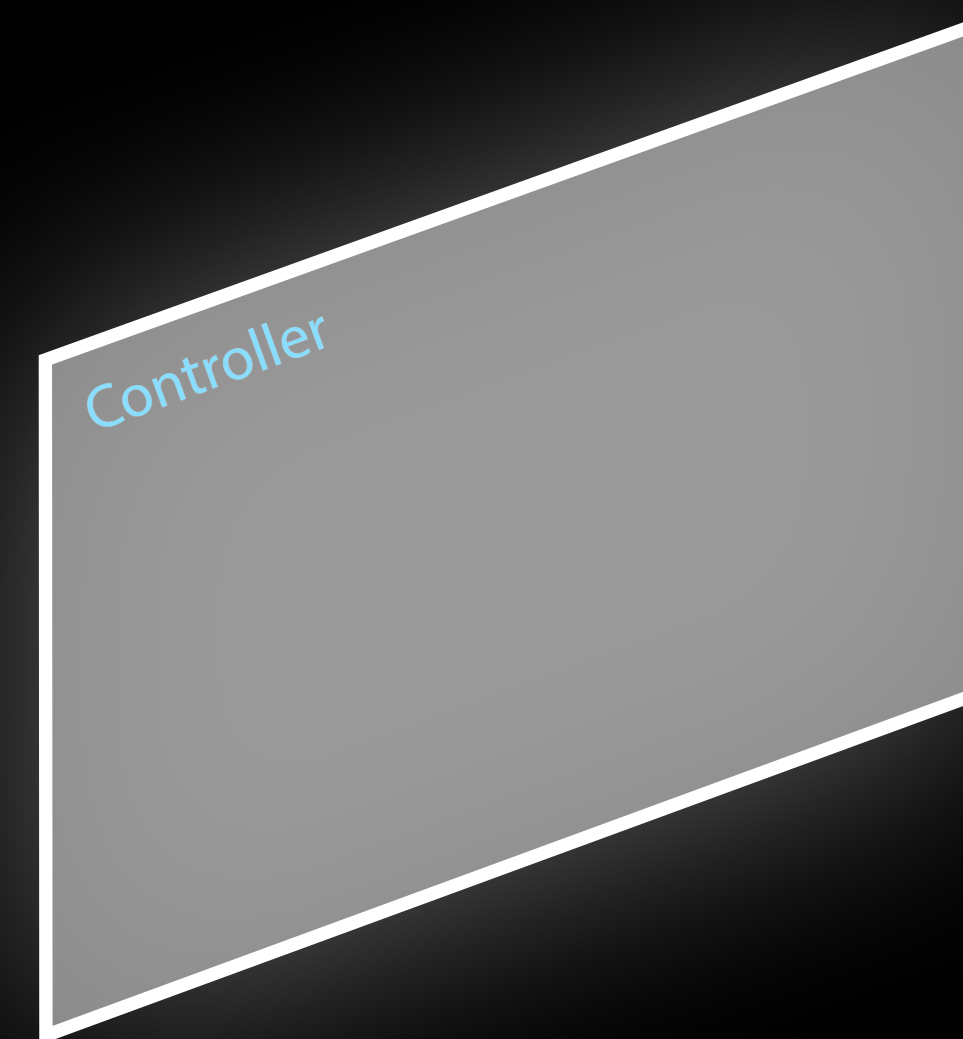
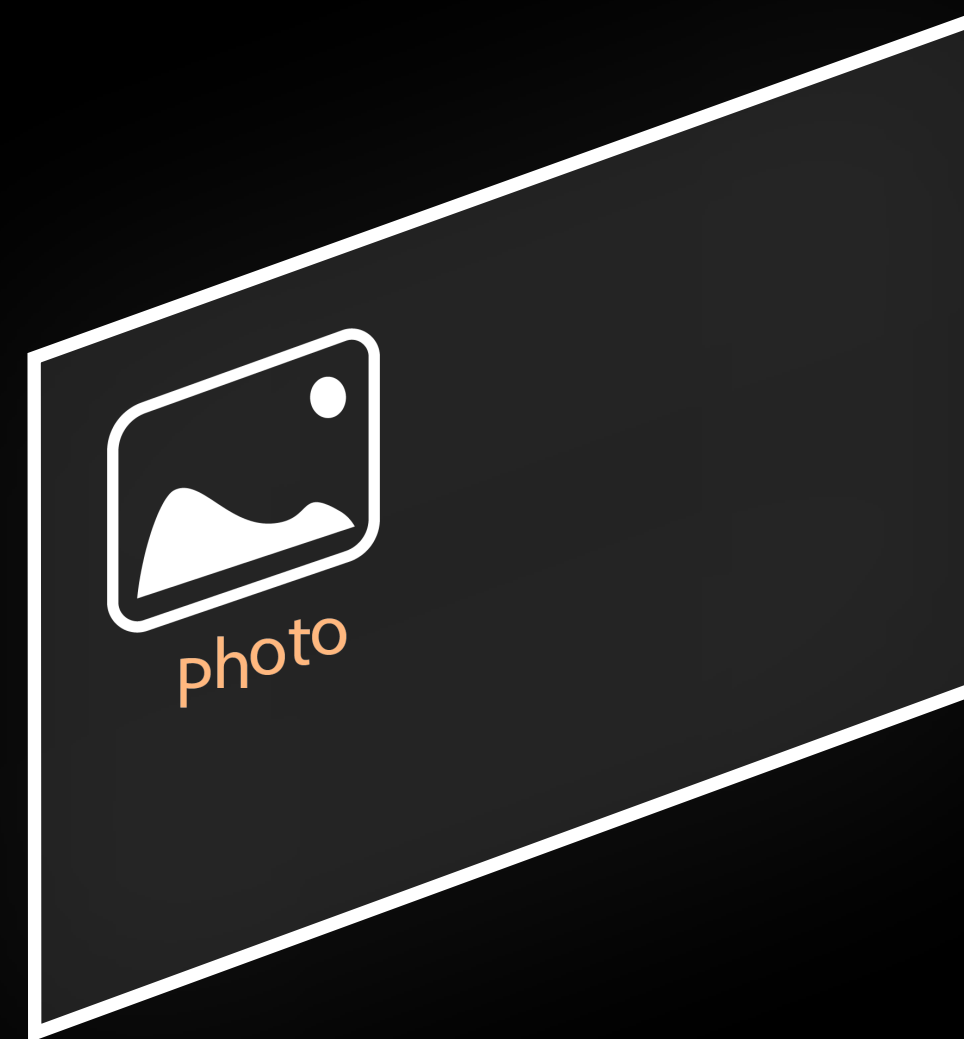
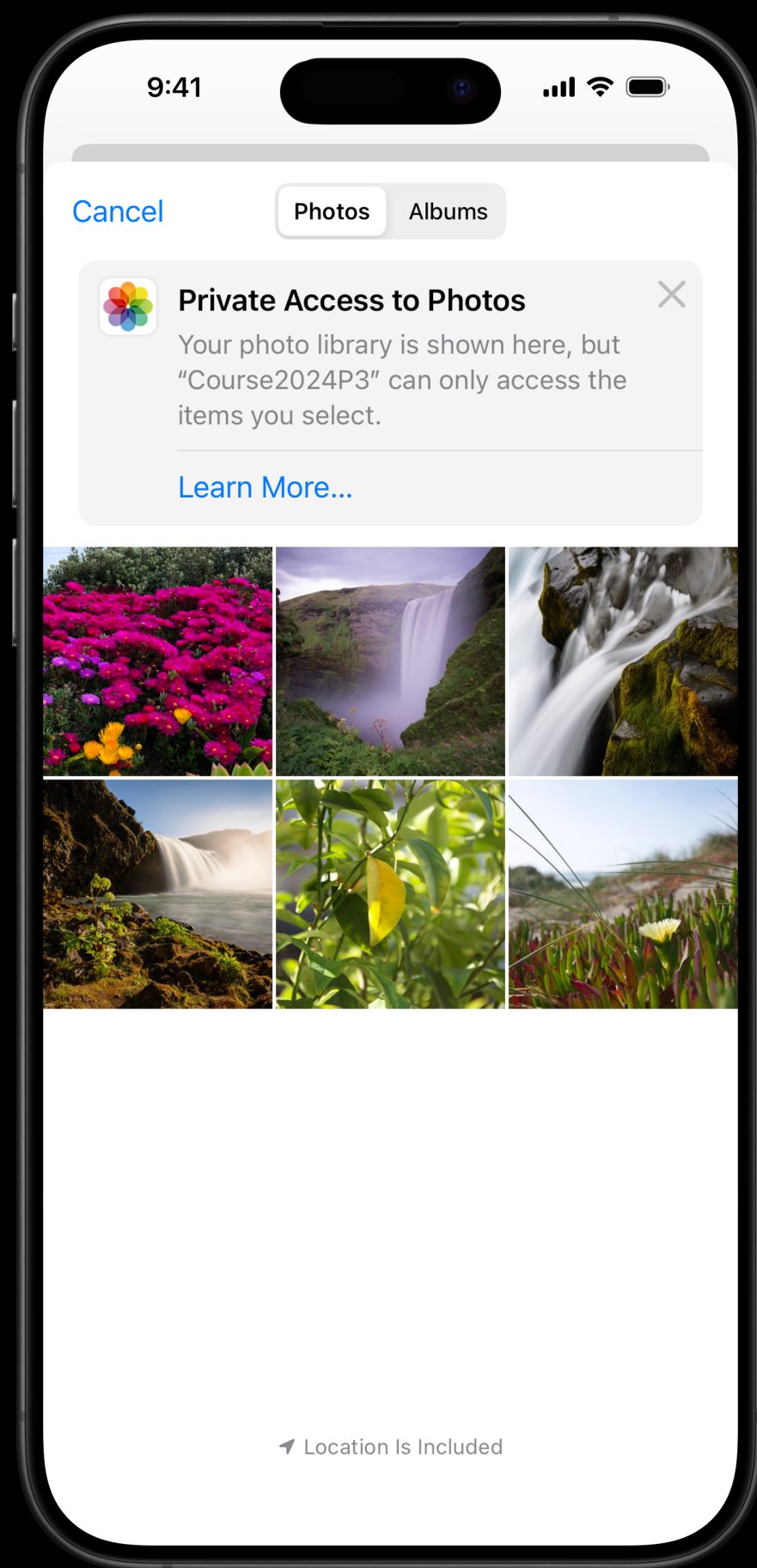
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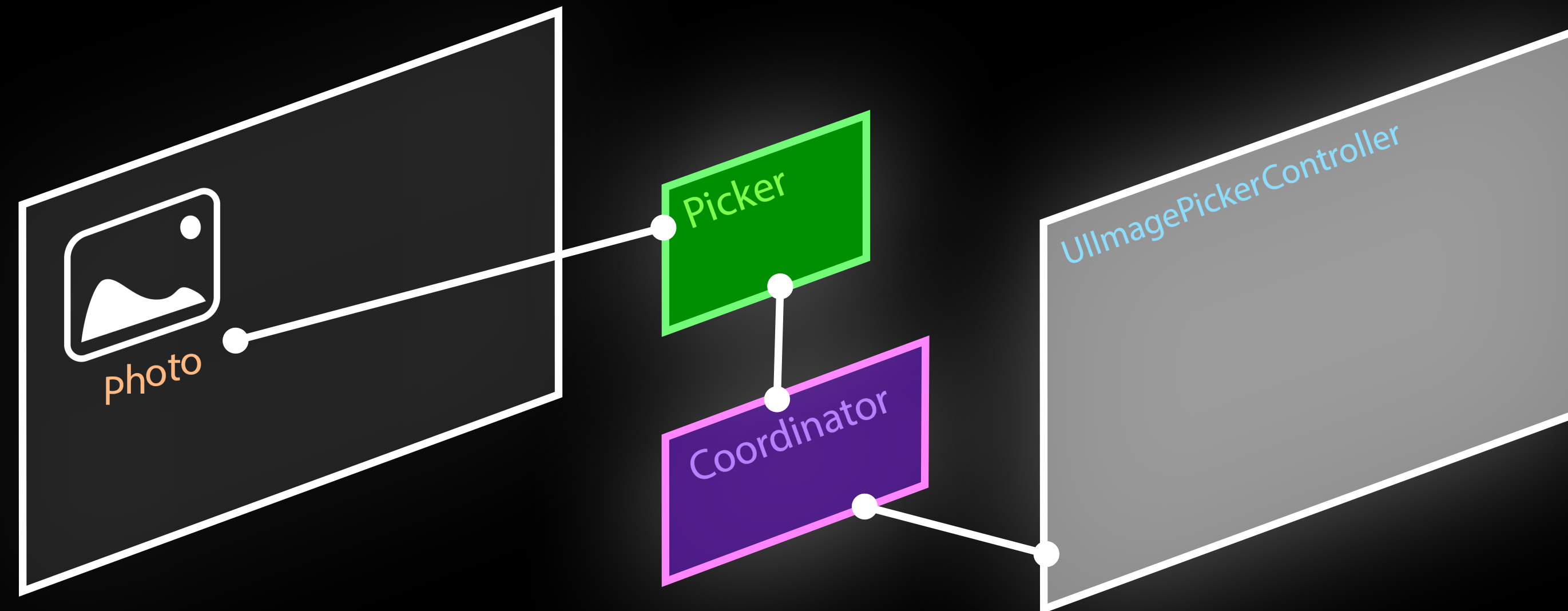
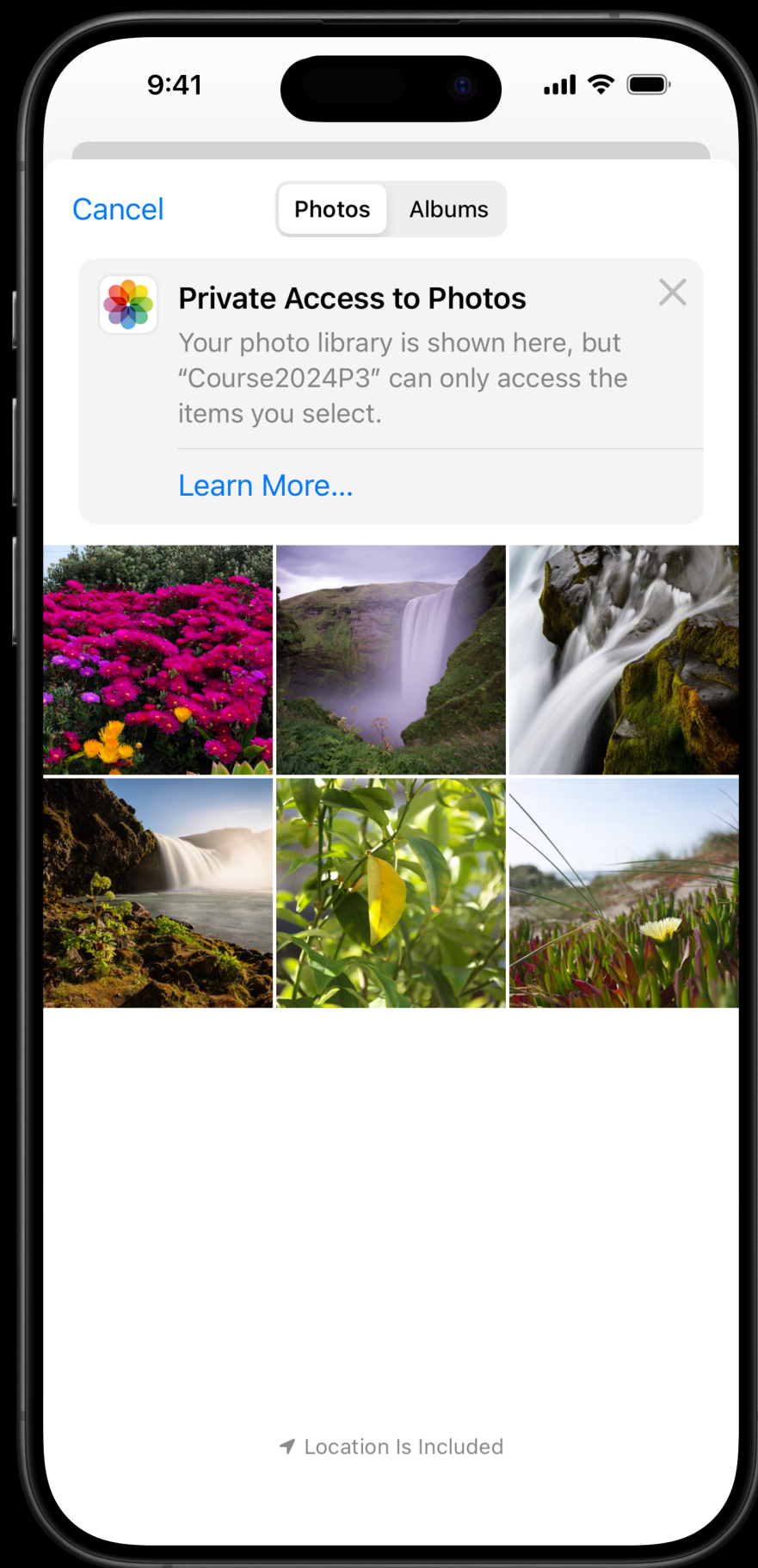
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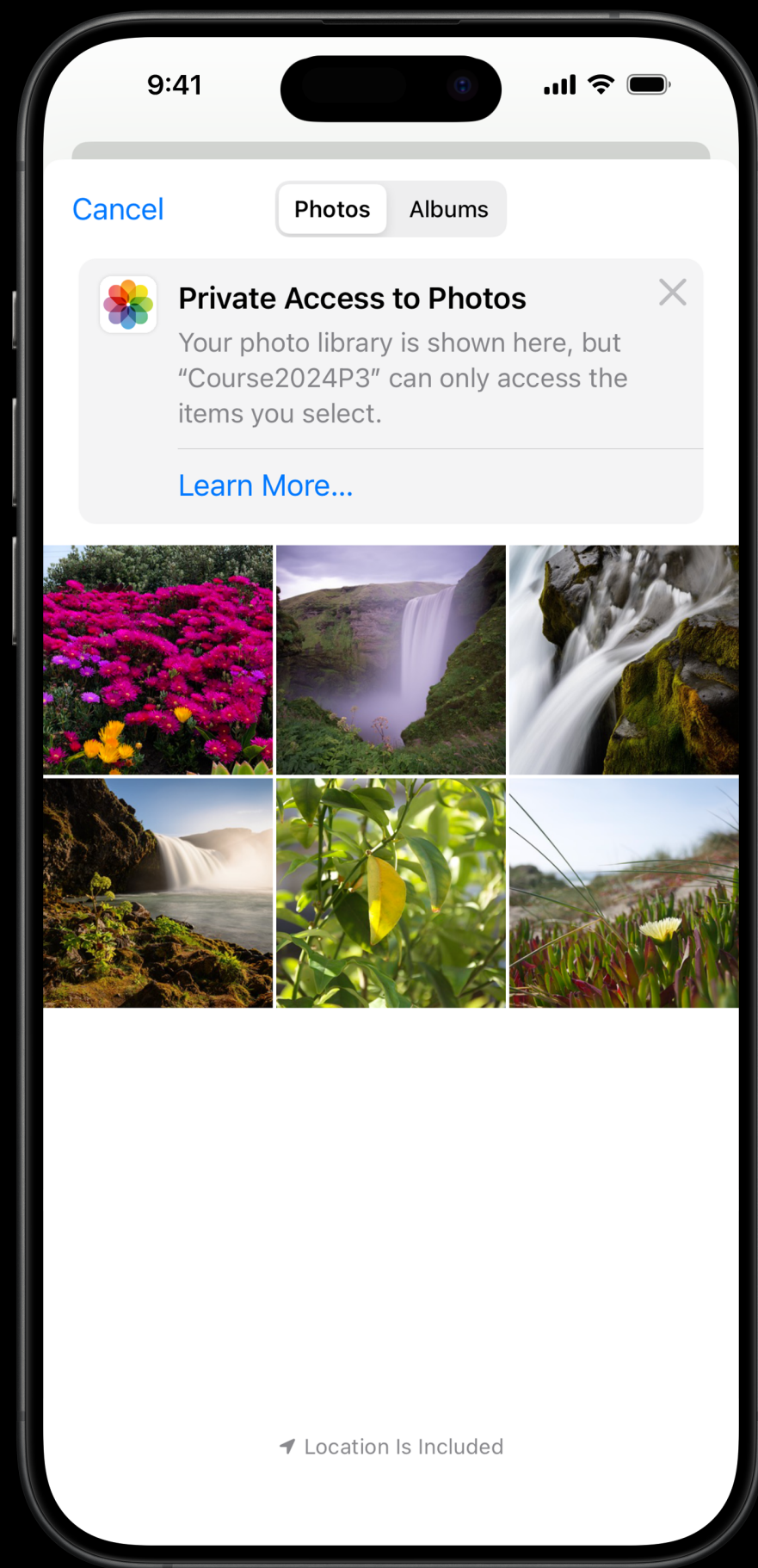


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SwiftUI与UIKit交互

Interfacing with UIKit



UIImagePickerController

iOS 2.0+

iPadOS 2.0+

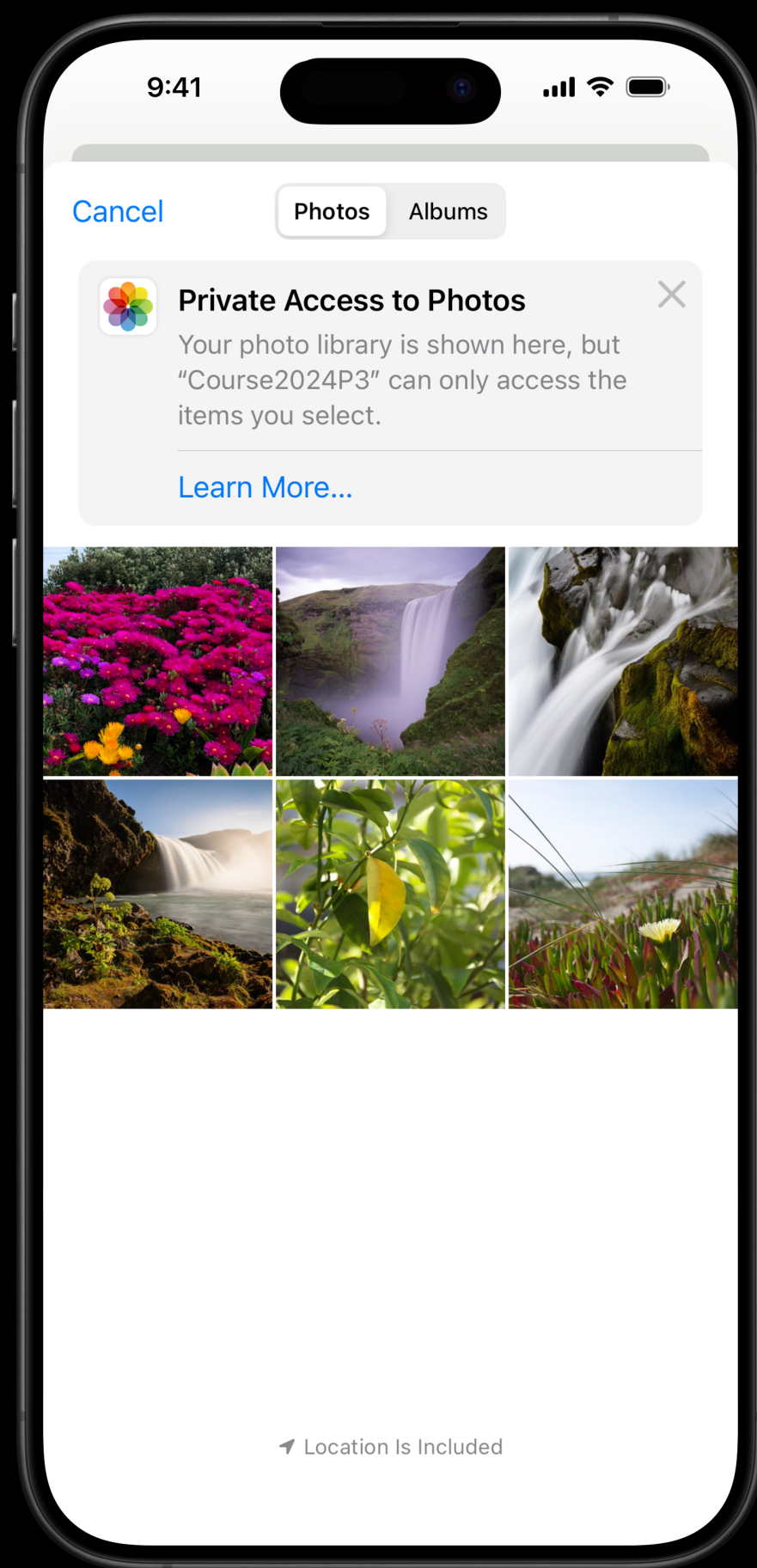
Mac Catalyst 13.1+

visionOS 1.0+

```
struct UIImagePickerControllerWrapper: UIViewControllerRepresentable{  
    func makeUIViewController(context: Context) -> UIImagePickerController {  
        return UIImagePickerController()  
    }  
  
    func updateUIViewController(_ viewController: UIImagePickerController,  
                                context: Context) {  
    }  
}
```


SwiftUI与UIKit交互

Interfacing with UIKit



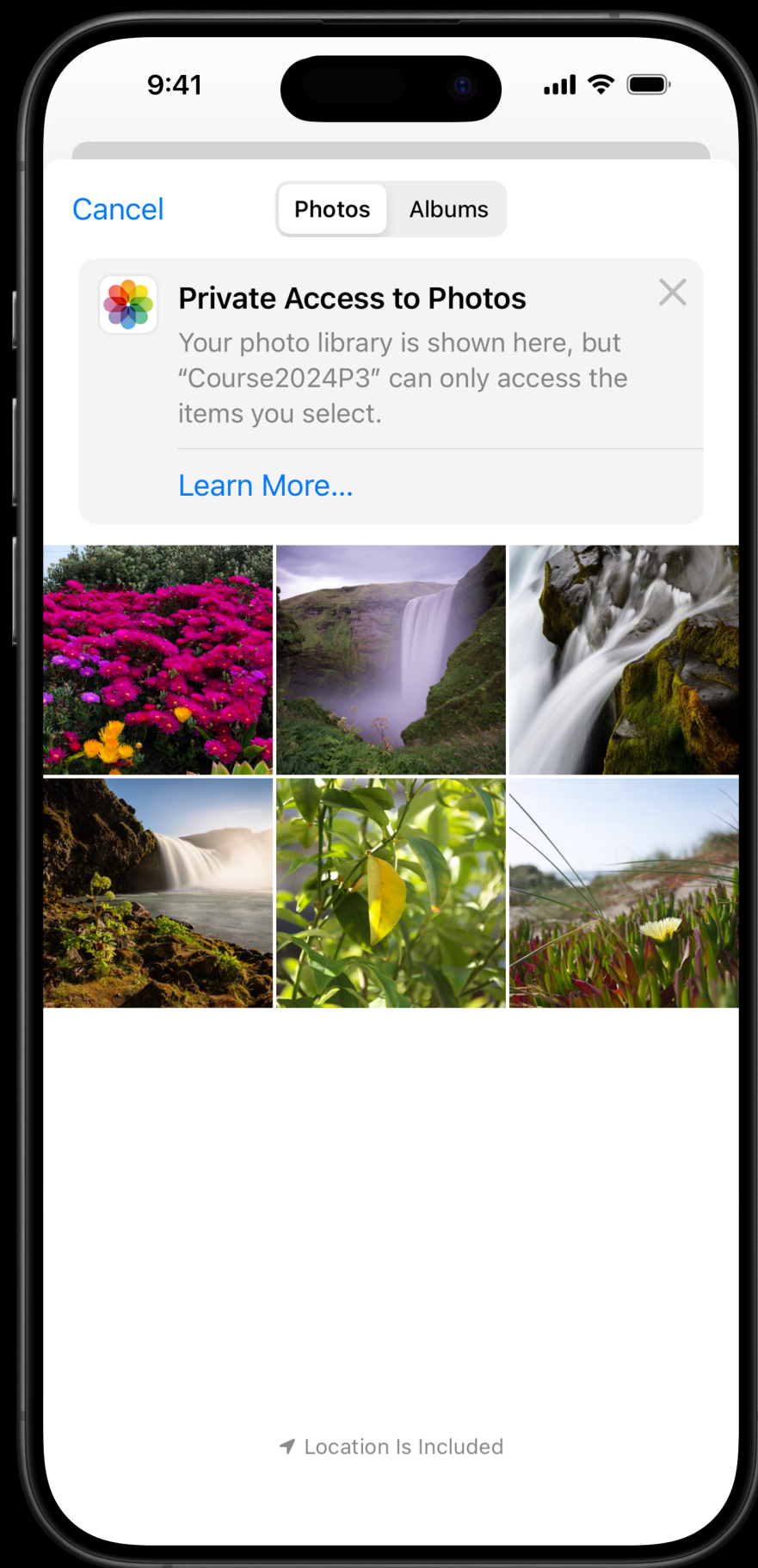
```
func makeCoordinator() -> Coordinator {  
    Coordinator()  
}  
  
class Coordinator{  
  
}
```


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2

```
func makeCoordinator() -> Coordinator {  
    Coordinator()  
}  
  
class Coordinator{  
  
}
```

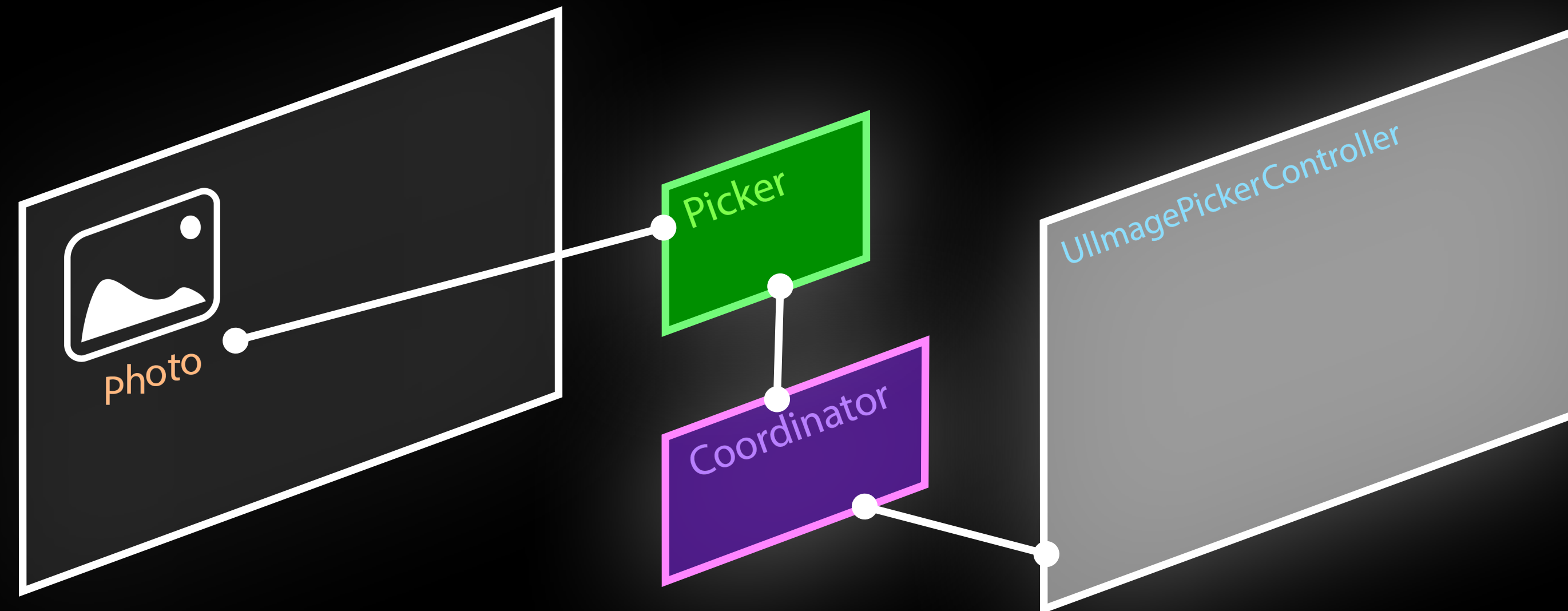
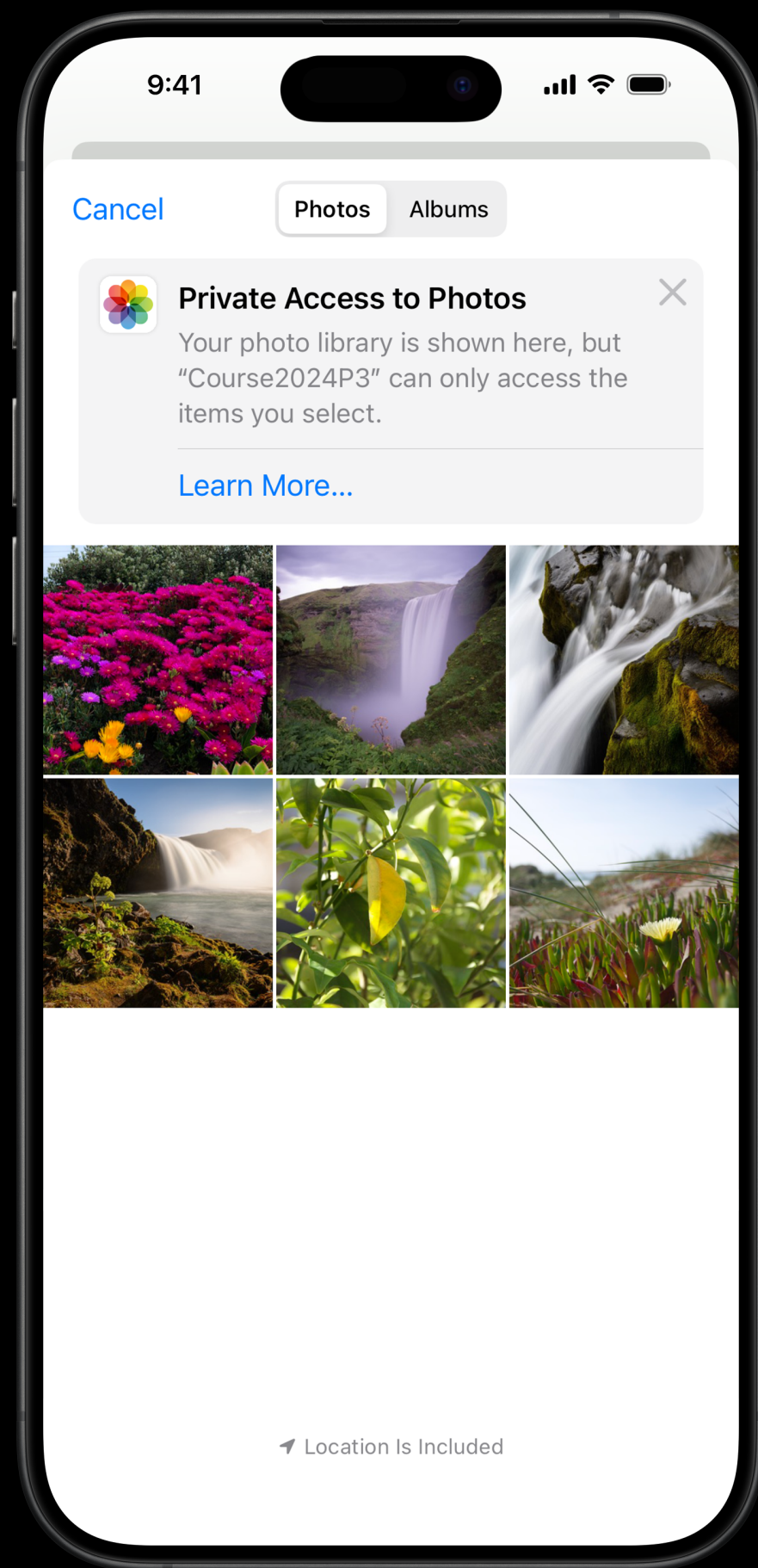
1

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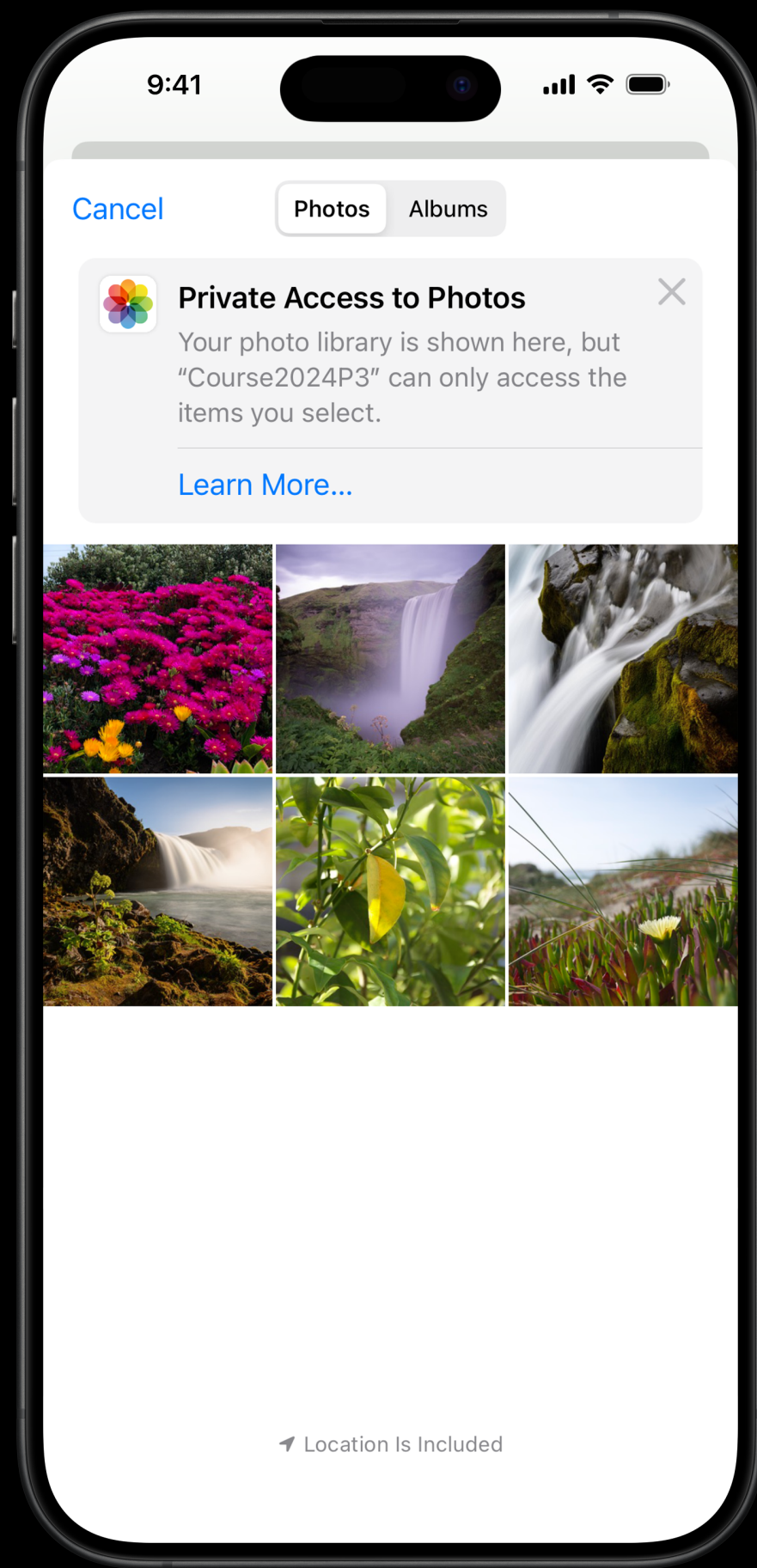


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```
let picker = UIImagePickerController()  
picker.delegate = context.coordinator  
return picker
```



Cannot assign value of type 'ImagePicker.Coordinator' to type '(UIImagePickerControllerDelegate & UINavigationControllerDelegate)?'

Do you want to add protocol stubs?

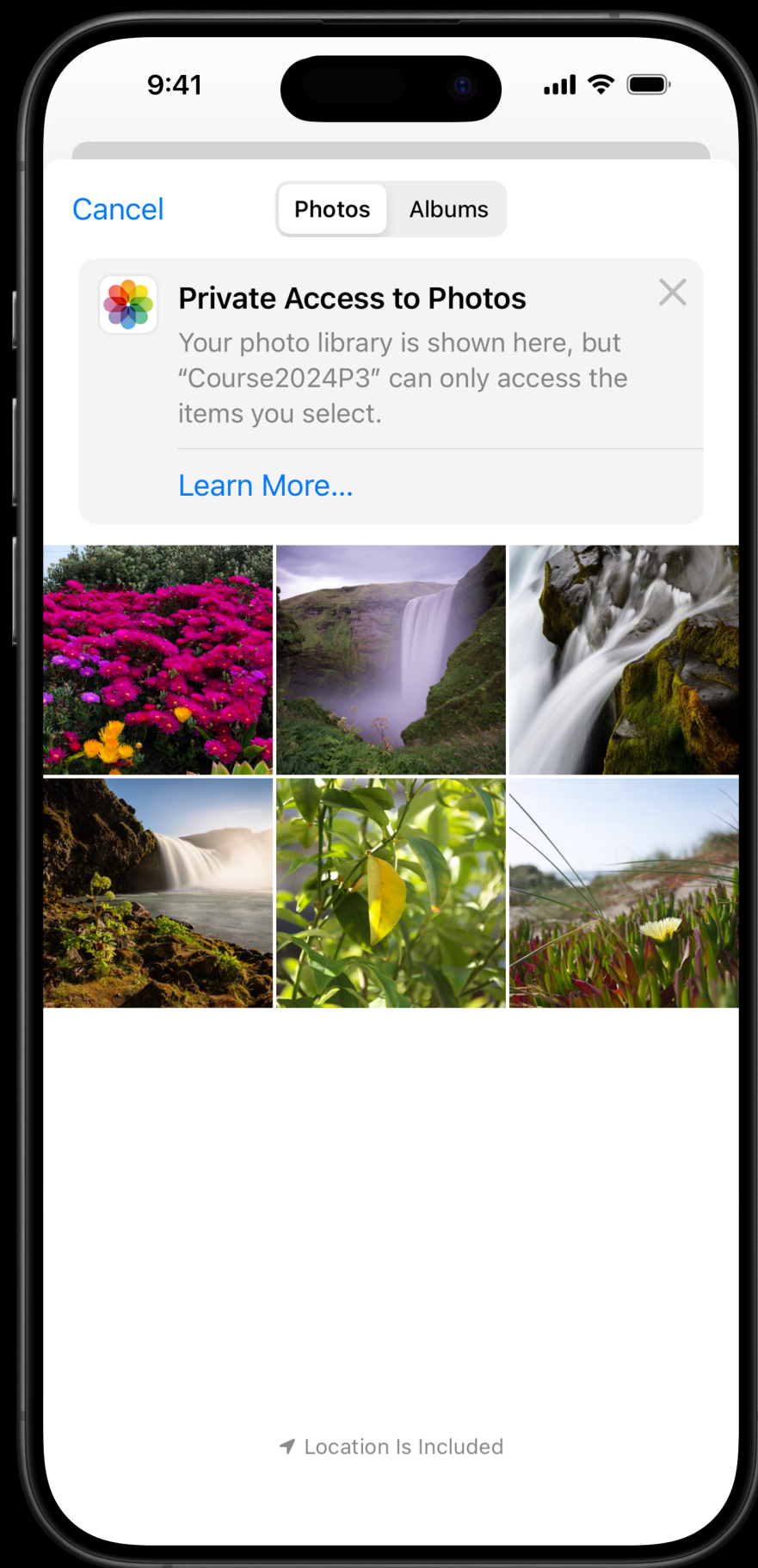
Fix it

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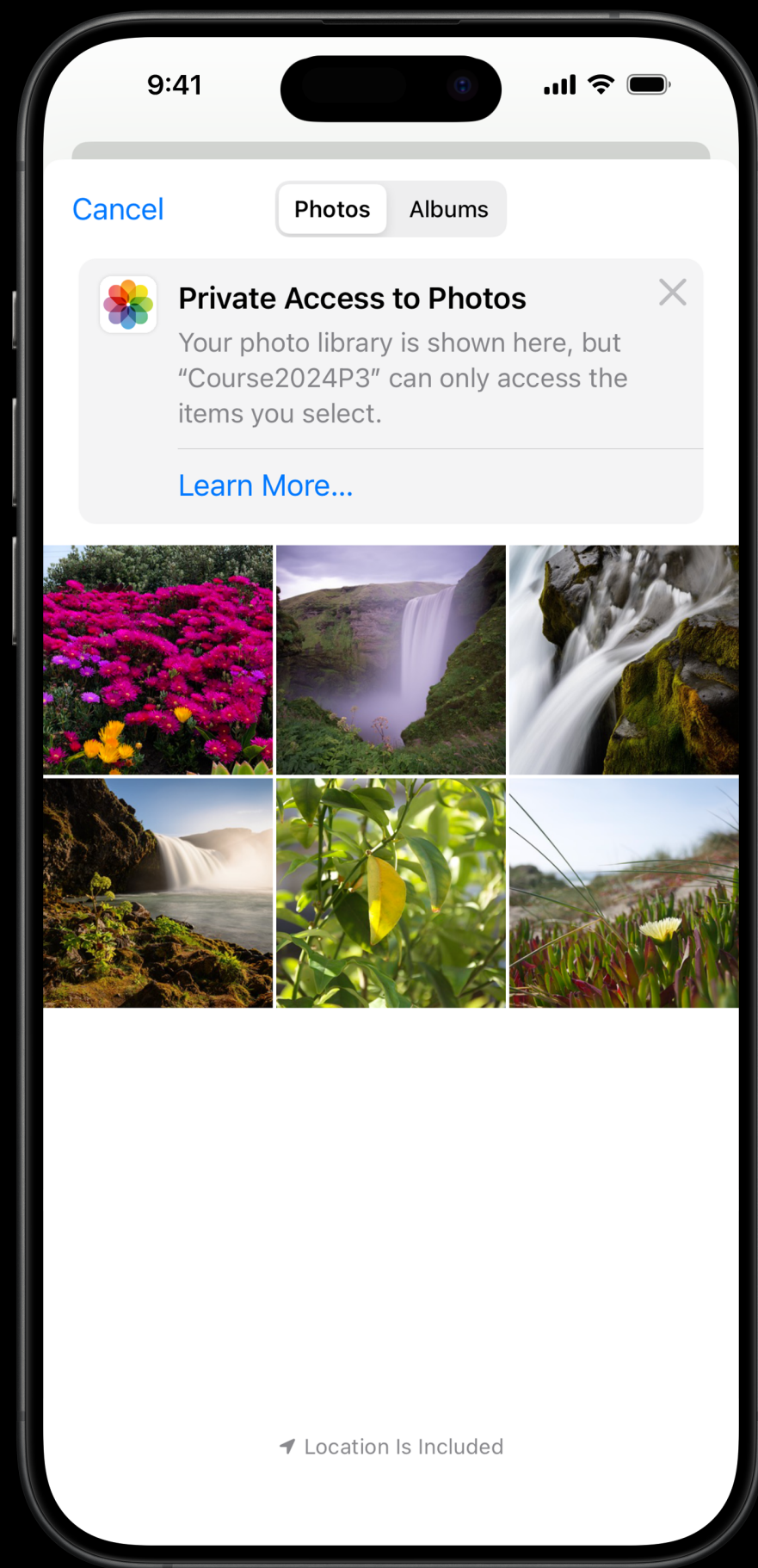


iOS应用的数据模式与SwiftUI和UIKit交互

```
class Coordinator: NSObject, UIImagePickerControllerDelegate,  
                  UINavigationControllerDelegate {  
  
}
```

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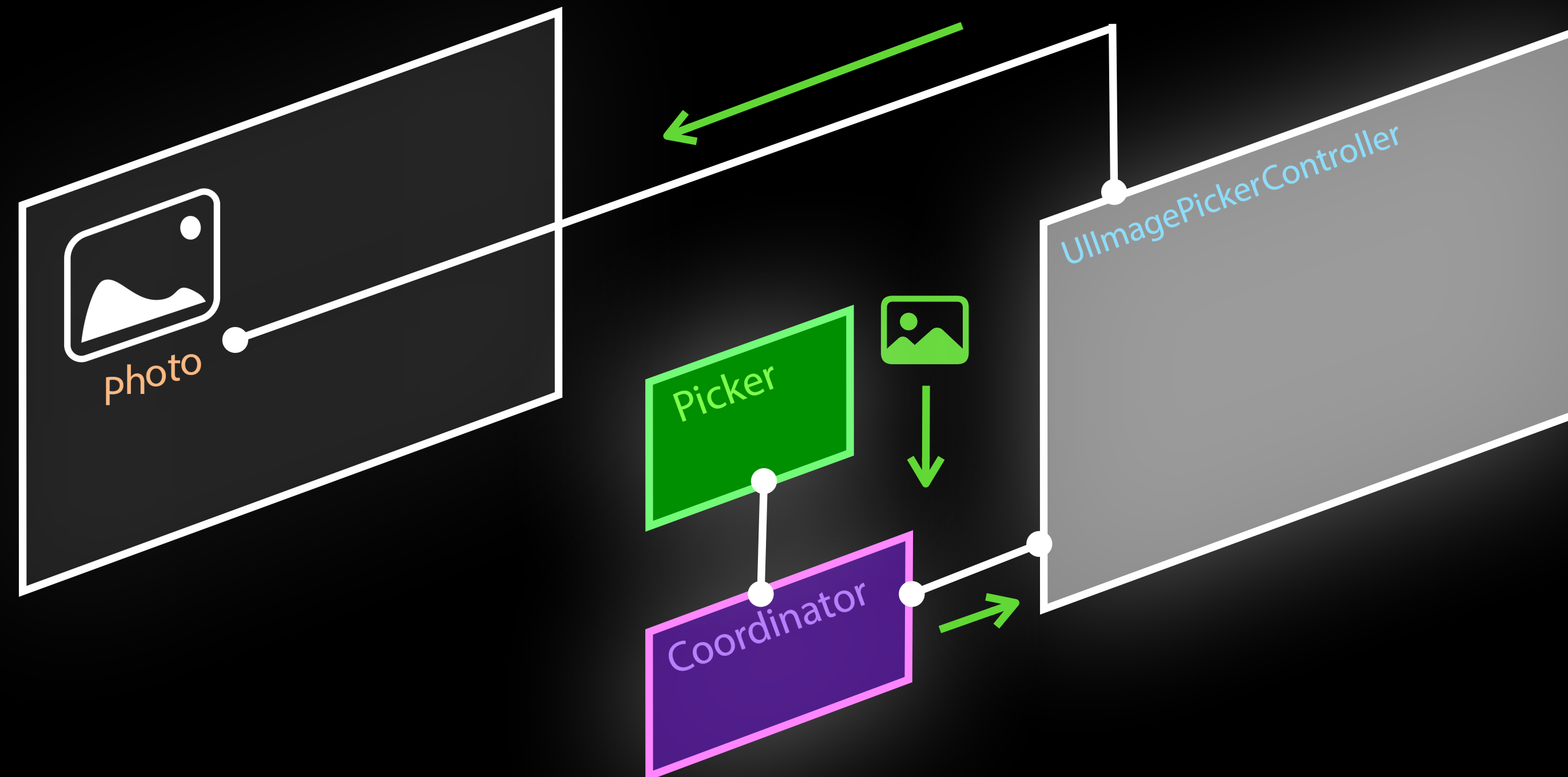
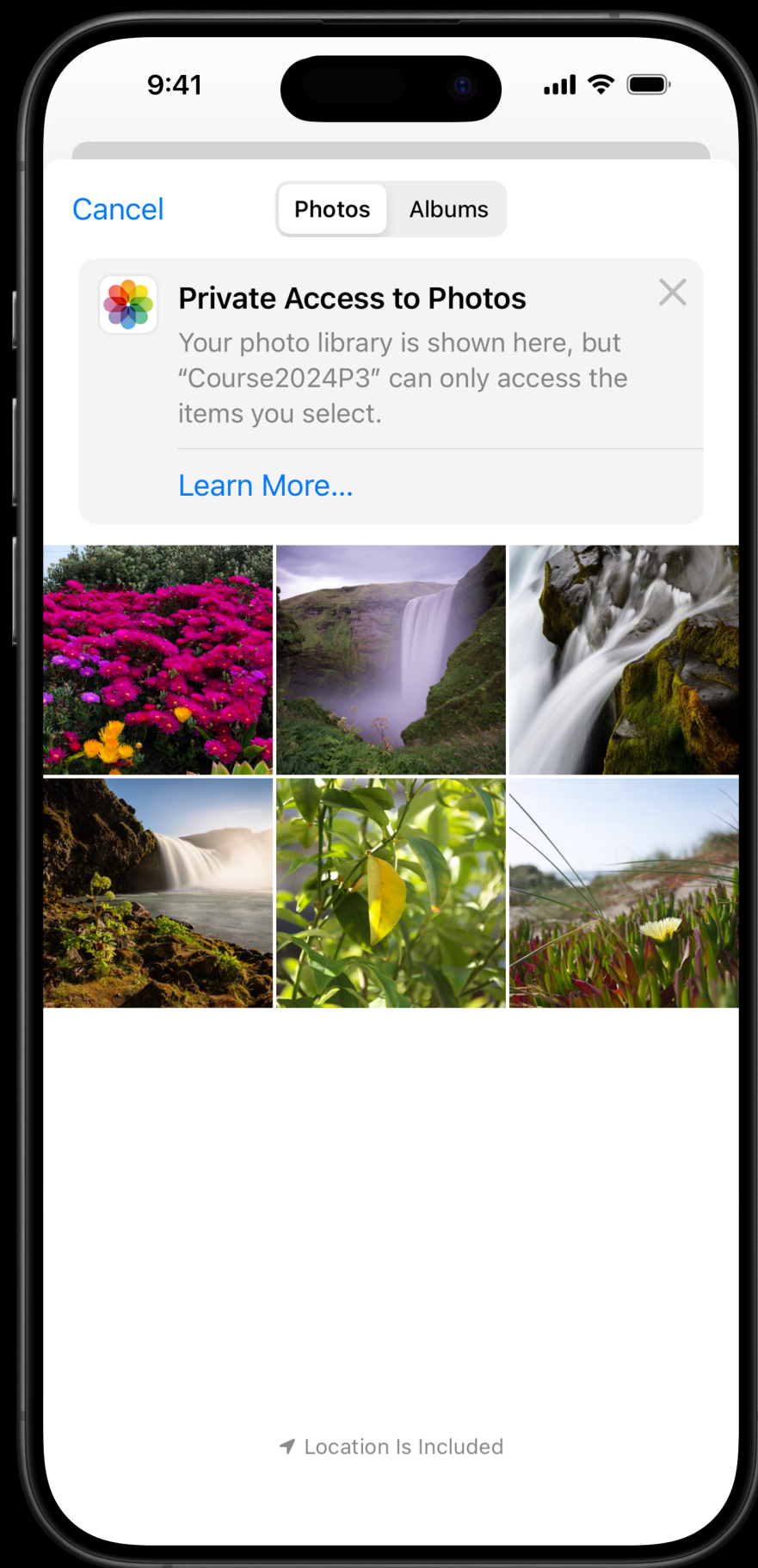
```
class Coordinator : NSObject, UIImagePickerControllerDelegate, UINavigationControllerDelegate {  
  
    func imagePickerController(_ picker: UIImagePickerController, didFinishPickingMediaWithInfo info: [UIImagePickerController.InfoKey : Any]) {  
        if let image = info[UIImagePickerController.InfoKey.originalImage] as? UIImage {  
              
        }  
    }  
}
```


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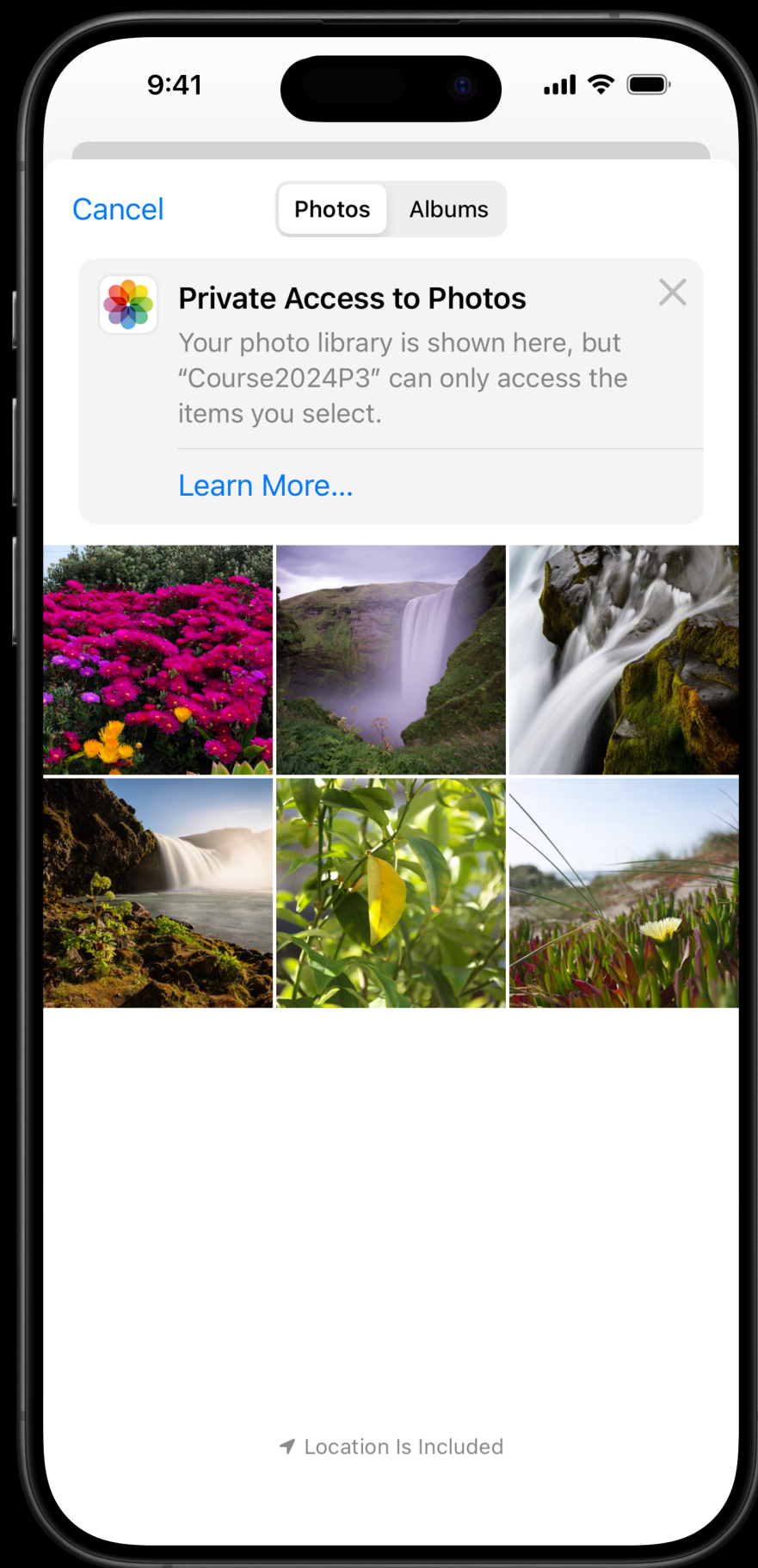


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iOS应用的数据模式与SwiftUI和UIKit交互

```
@Binding var selectedImage: UIImage?
```

```
self
```

```
var parent: UIImagePickerControllerWrapper  
init(_ parent: UIImagePickerControllerWrapper) {  
    self.parent = parent  
}
```

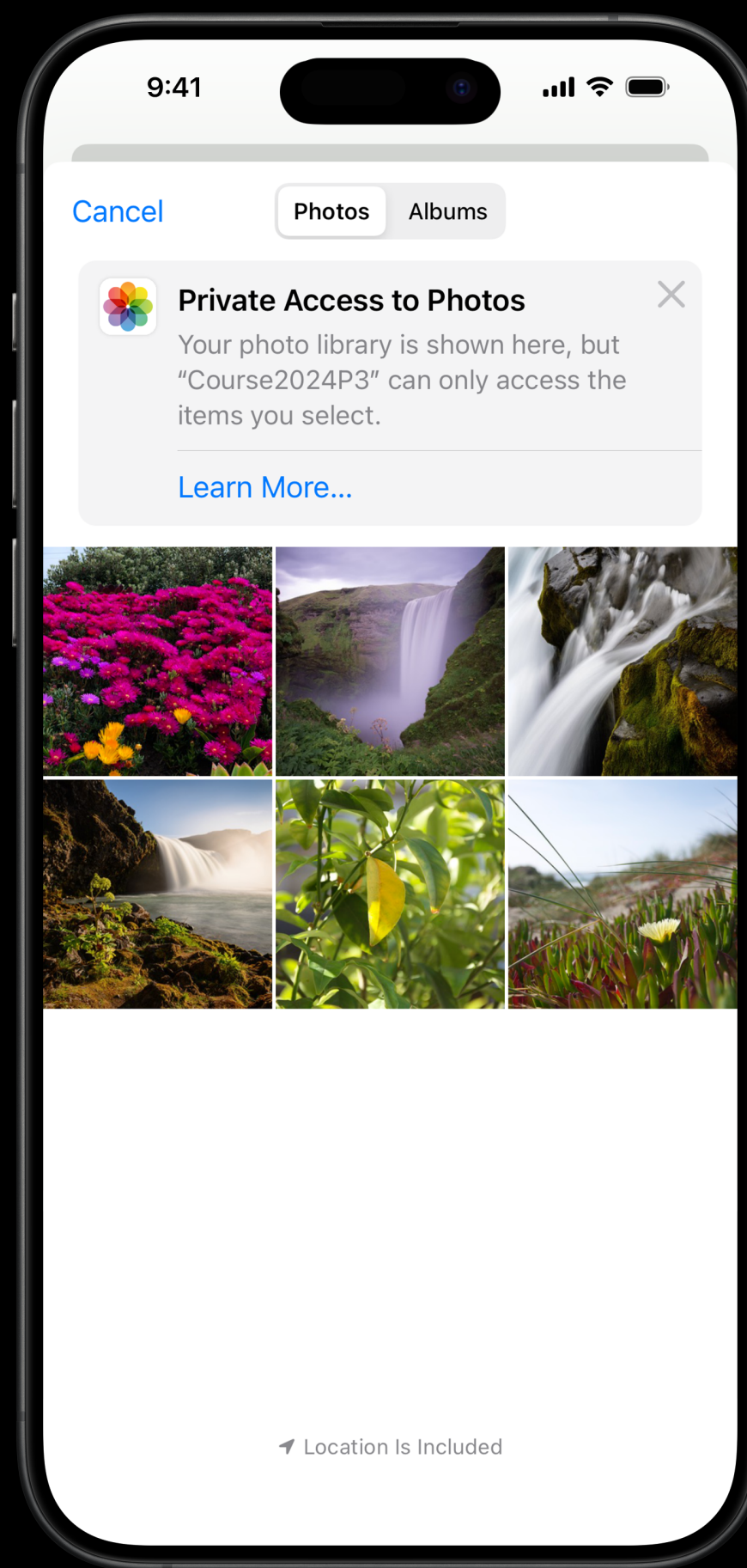
```
}
```

```
...
```



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```
struct PhotoPickerView: View {
    @State private var image: Image?
    @State private var showingImagePicker = false
    @State private var pickedImage: UIImage?

    var body: some View {
        VStack {
            image?
                .resizable()
                .scaledToFit()

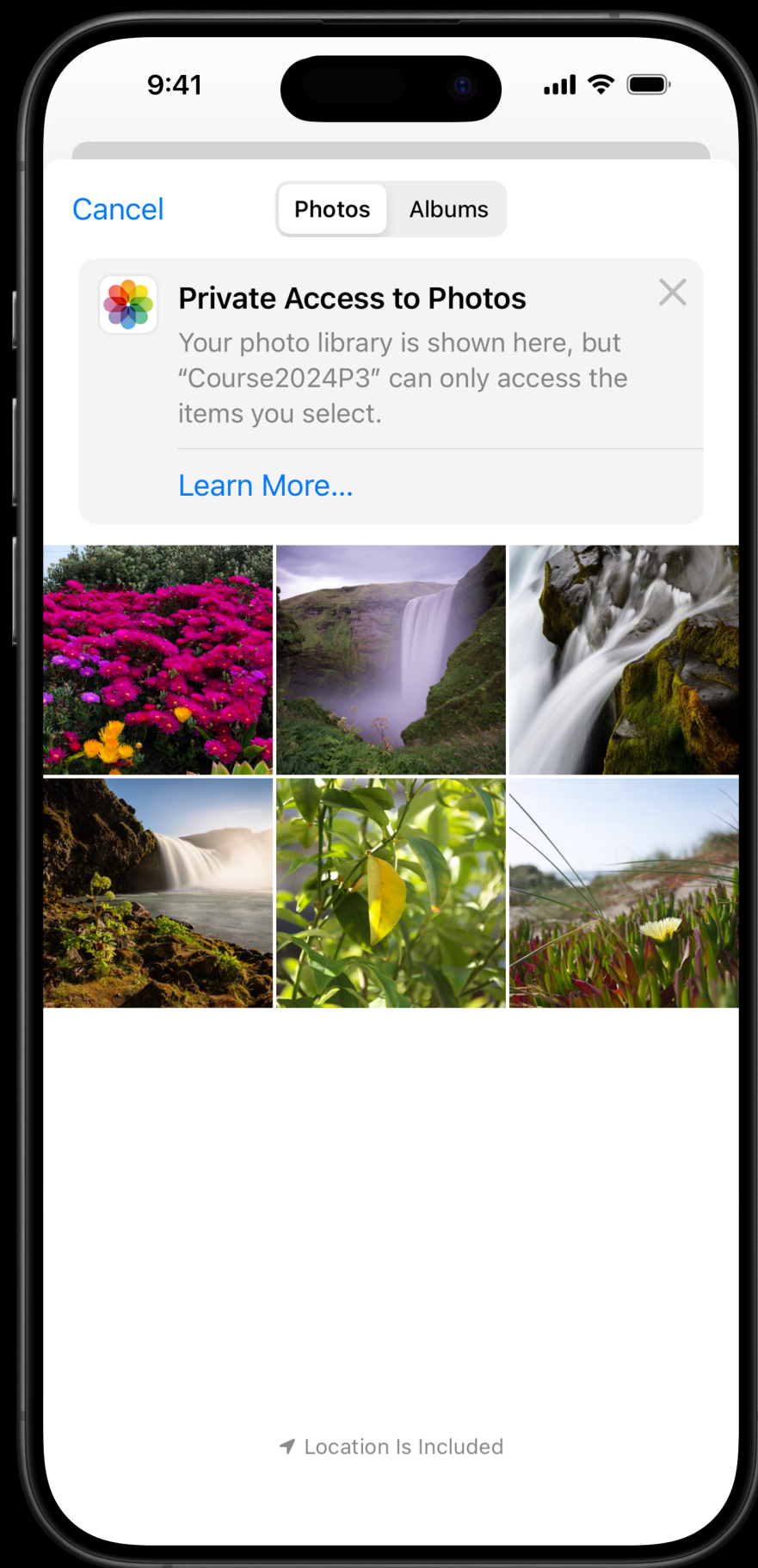
            Button("Select Image") {
                showingImagePicker = true
            }
        }
        .sheet(isPresented: $showingImagePicker) {
            UIImagePickerControllerWrapper(selectedImage: $pickedImage)
                .ignoresSafeArea()
        }
    }
}
```


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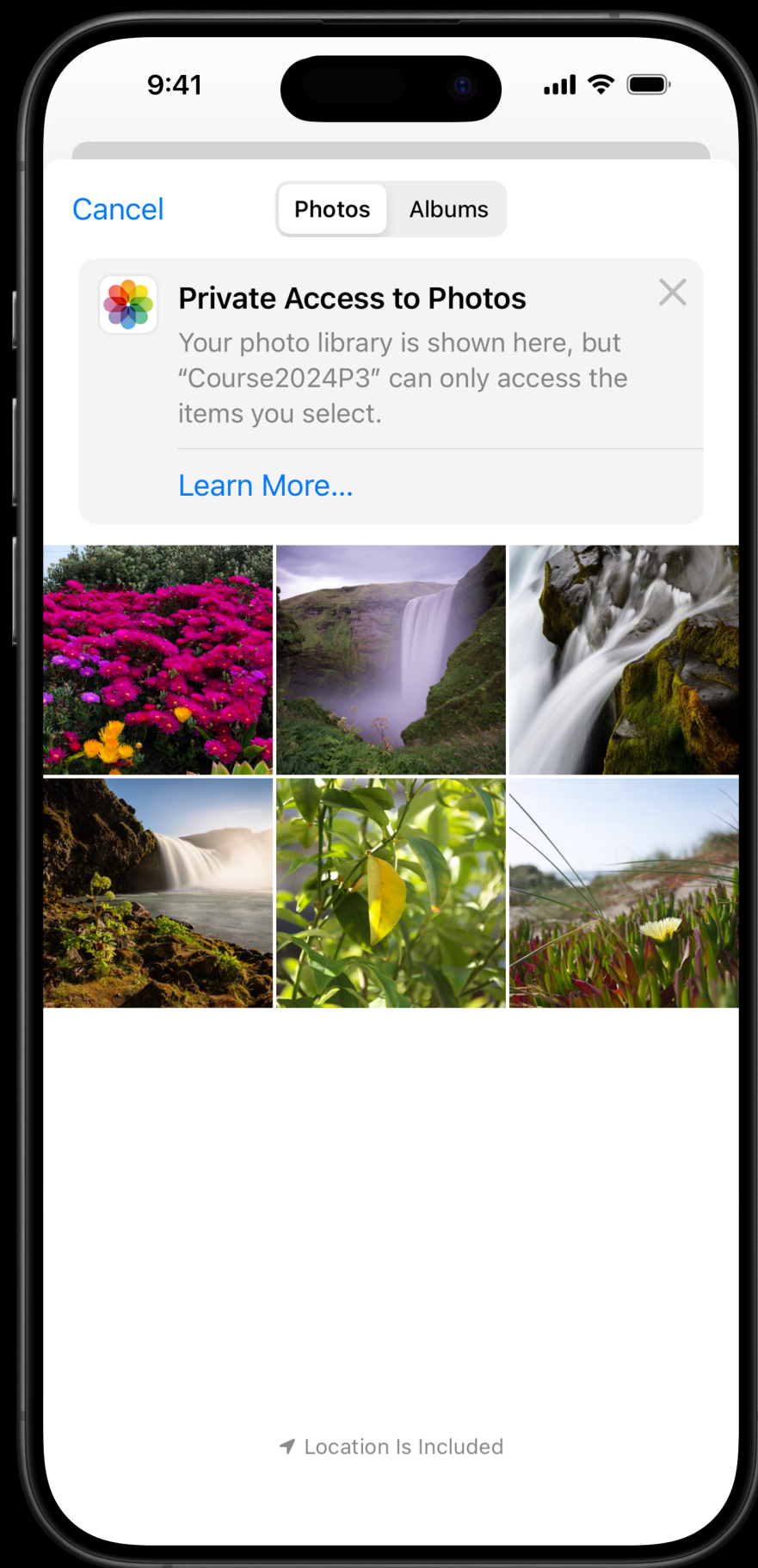
```
@State private var pickedImage: UIImage?
```


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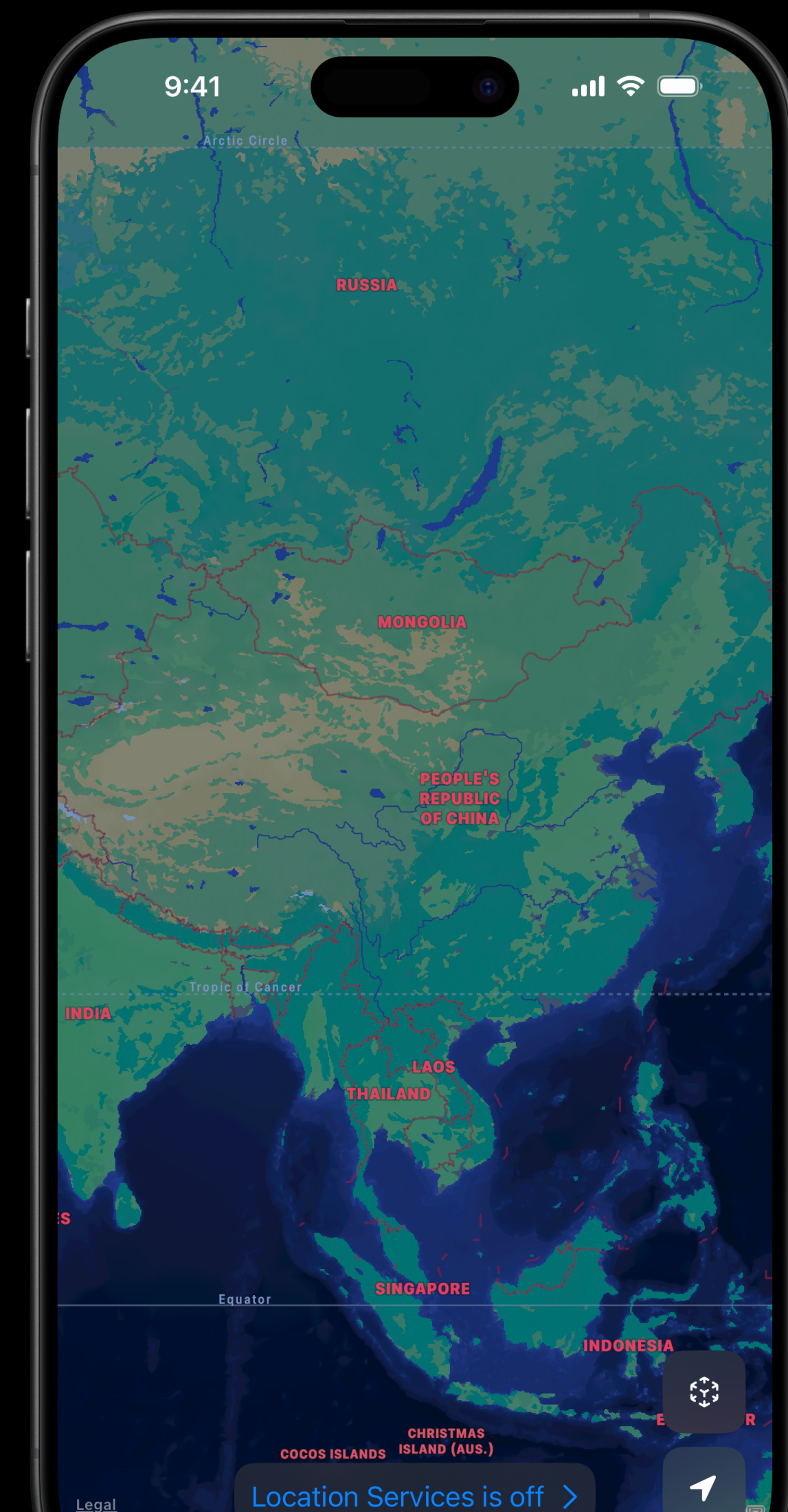
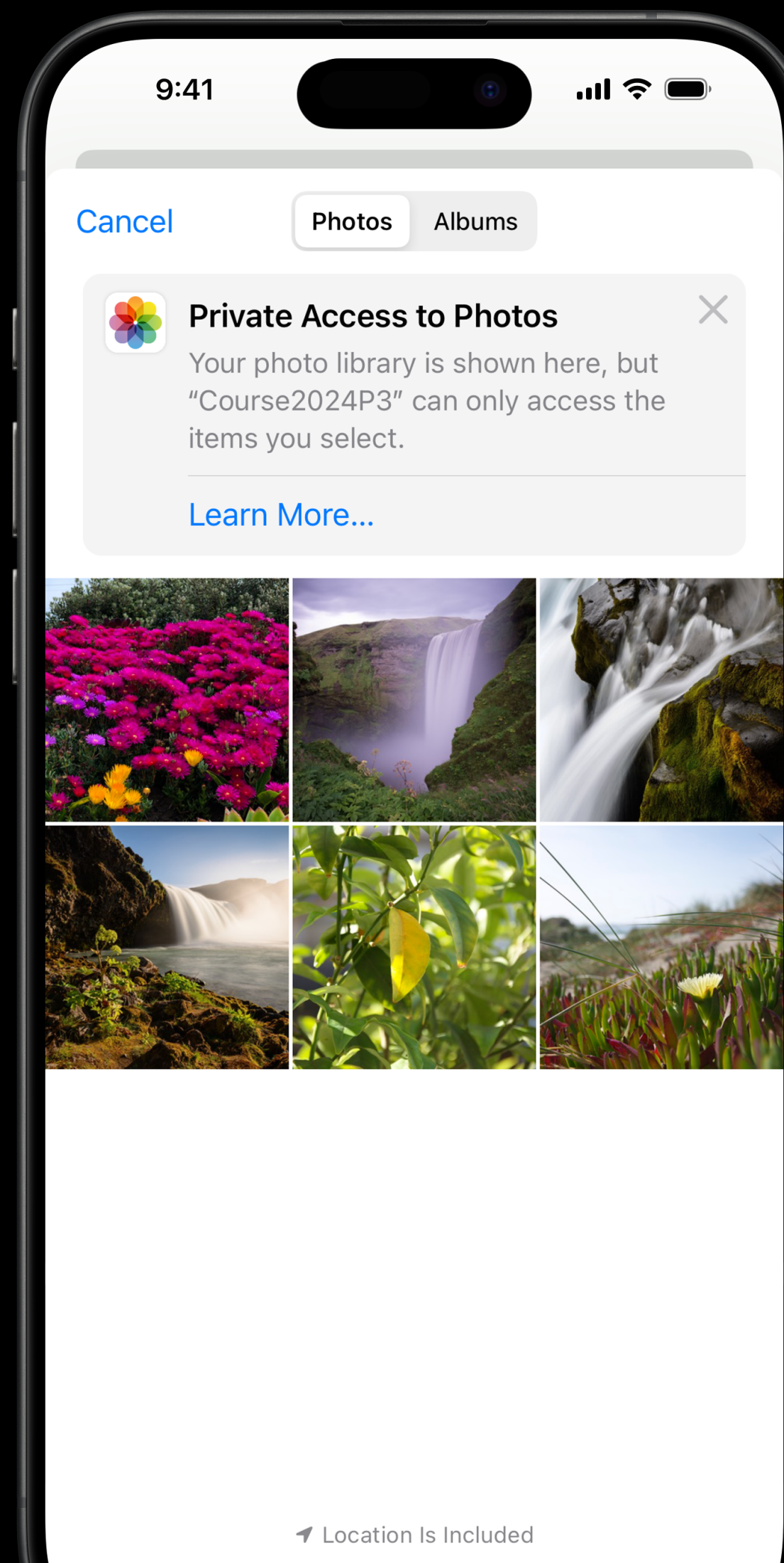
iOS应用的数据模式与SwiftUI和UIKit交互

```
.onChange(of: pickedImage, { loadImage() })
```

```
func loadImage(){  
    guard let theImage = pickedImage else {return}  
    image = Image(uiImage: theImage)  
}
```


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```
import MapKit
```

```
struct MKMapViewWrapper: UIViewRepresentable {
```

```
    func makeUIView(context: Context) -> MKMapView {
```

```
        let view = MKMapView()
```

```
        view.showsUserLocation = true
```

```
        return view
```

```
    }
```

```
    func updateUIView(_ uiView: MKMapView, context: Context) {
```

```
    }
```

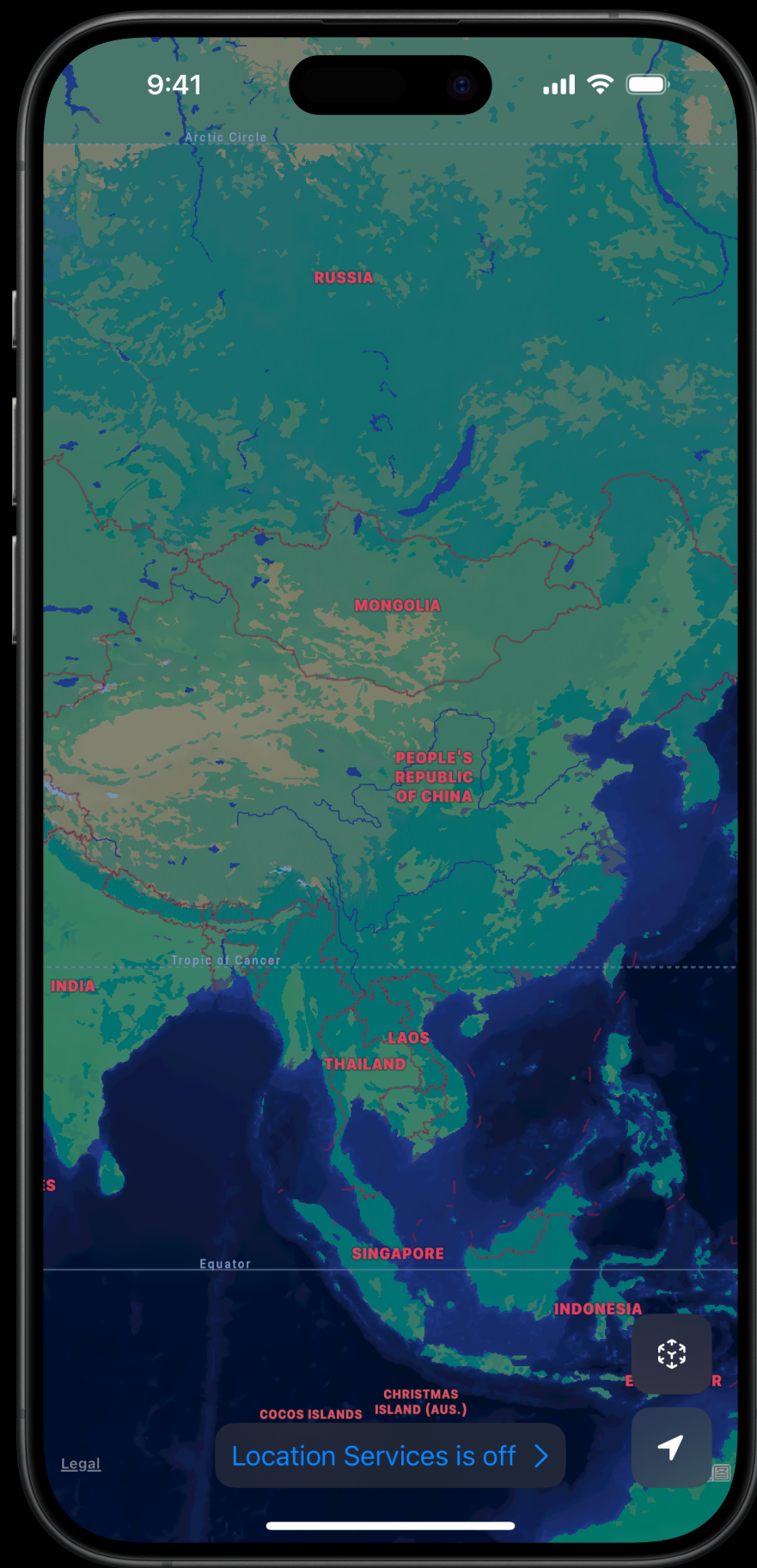
```
}
```


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```
import MapKit
```

```
struct MKMapViewWrapper: UIViewRepresentable {
```

```
    func makeUIView(context: Context) -> MKMapView {
```

```
        let view = MKMapView()
```

```
        let locationManager = CLLocationManager()
```

```
        view.showsUserLocation = true
```

```
        return view
```

```
    }
```

```
    func updateUIView(_ uiView: MKMapView, context: Context) {
```

```
    }
```

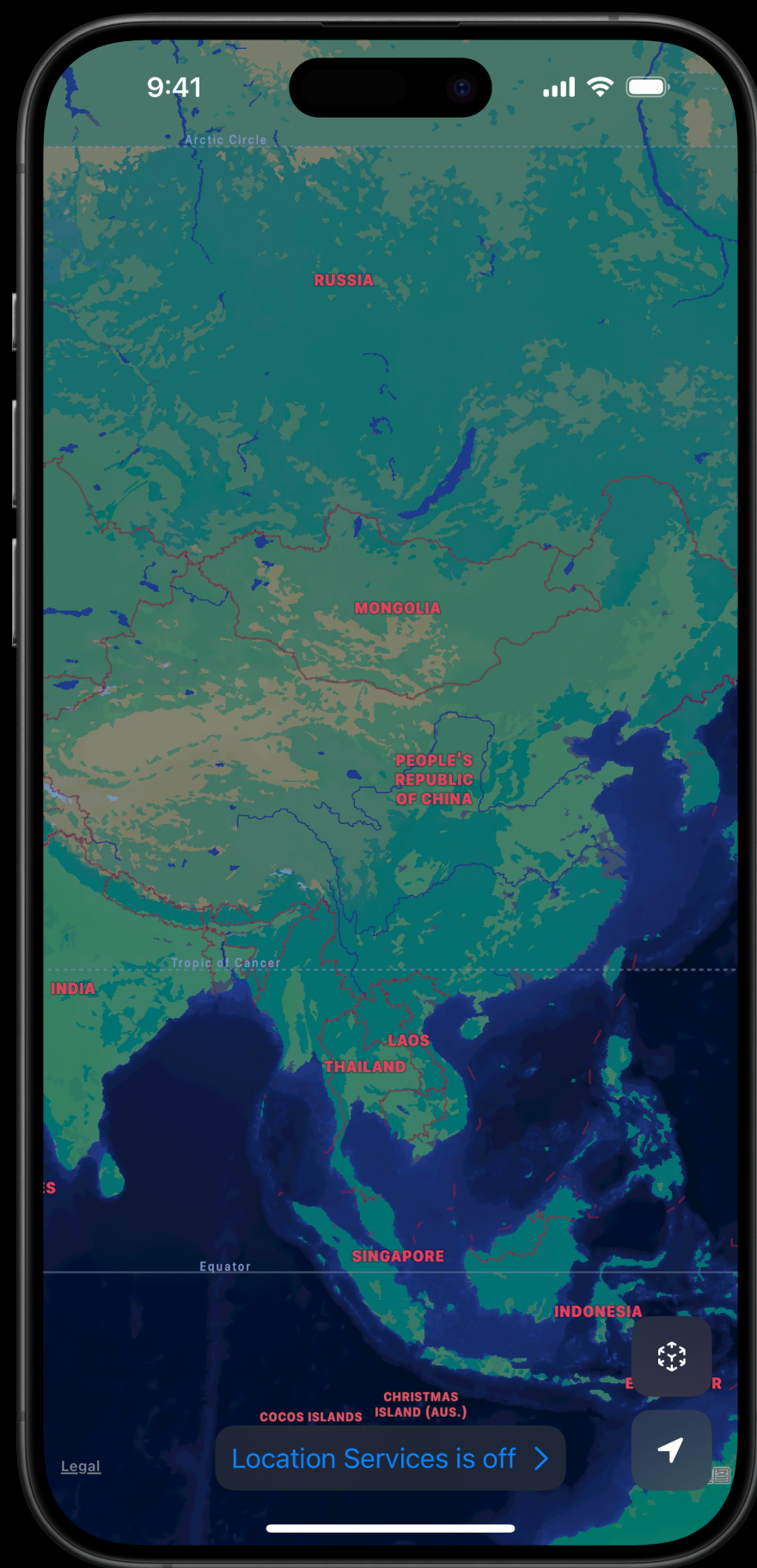
```
}
```

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```
import MapKit
```

```
struct MKMapViewWrapper: UIViewRepresentable {
```

```
func makeUIView(context: Context) -> MKMapView {
```

```
let view = MKMapView()
```

```
let locationManager = CLLocationManager()
```

```
view.showsUserLocation = true
```

```
return view
```

```
}
```

```
func updateUIView(_ uiView: MKMapView, context: Context) {
```

```
}
```

```
}
```

@ObservableObject

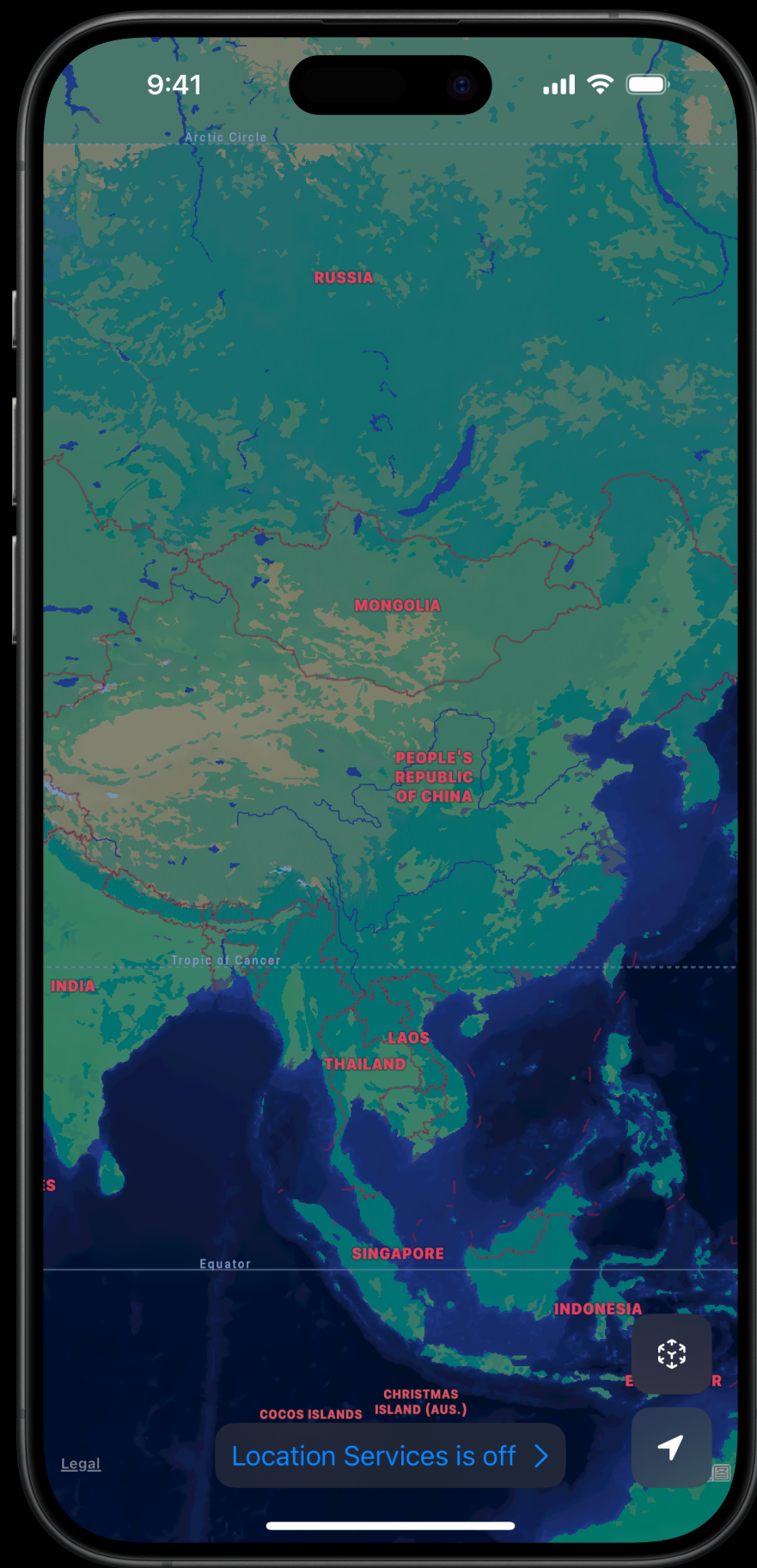
MODEL

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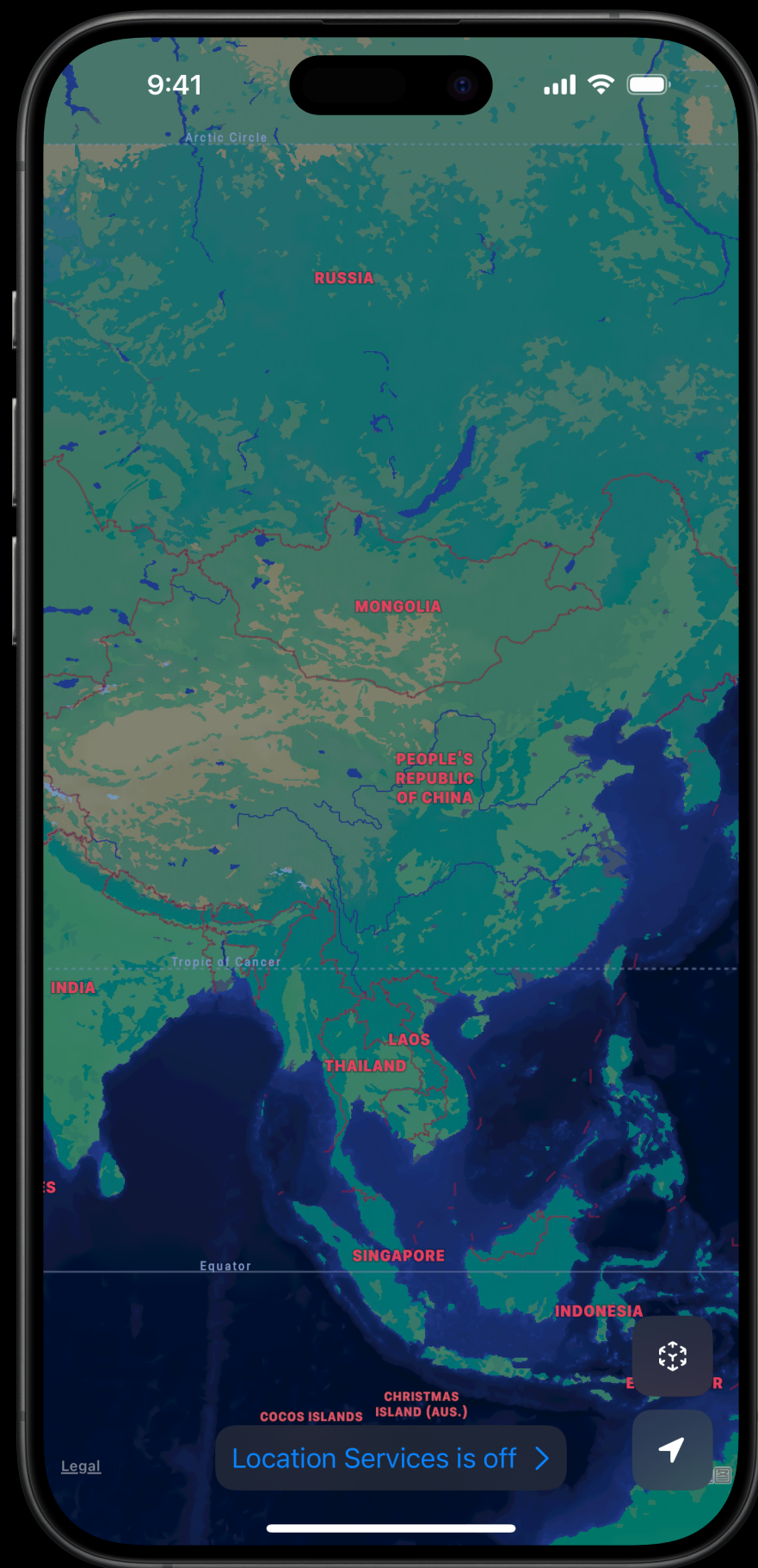
```
class MapViewModel: ObservableObject {  
    @Published var mapView = MKMapView()  
  
    override init(){  
        super.init()  
    }  
}
```


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iOS应用的数据模式与SwiftUI和UIKit交互

```
class MapViewModel: ObservableObject {
    @Published var mapView = MKMapView()

    override init() {
        super.init()
    }
}

struct MKMapViewWrapper: UIViewRepresentable {
    @EnvironmentObject var mapData: MapViewModel

    func makeUIView(context: Context) -> MKMapView {
        return mapData.mapView
    }

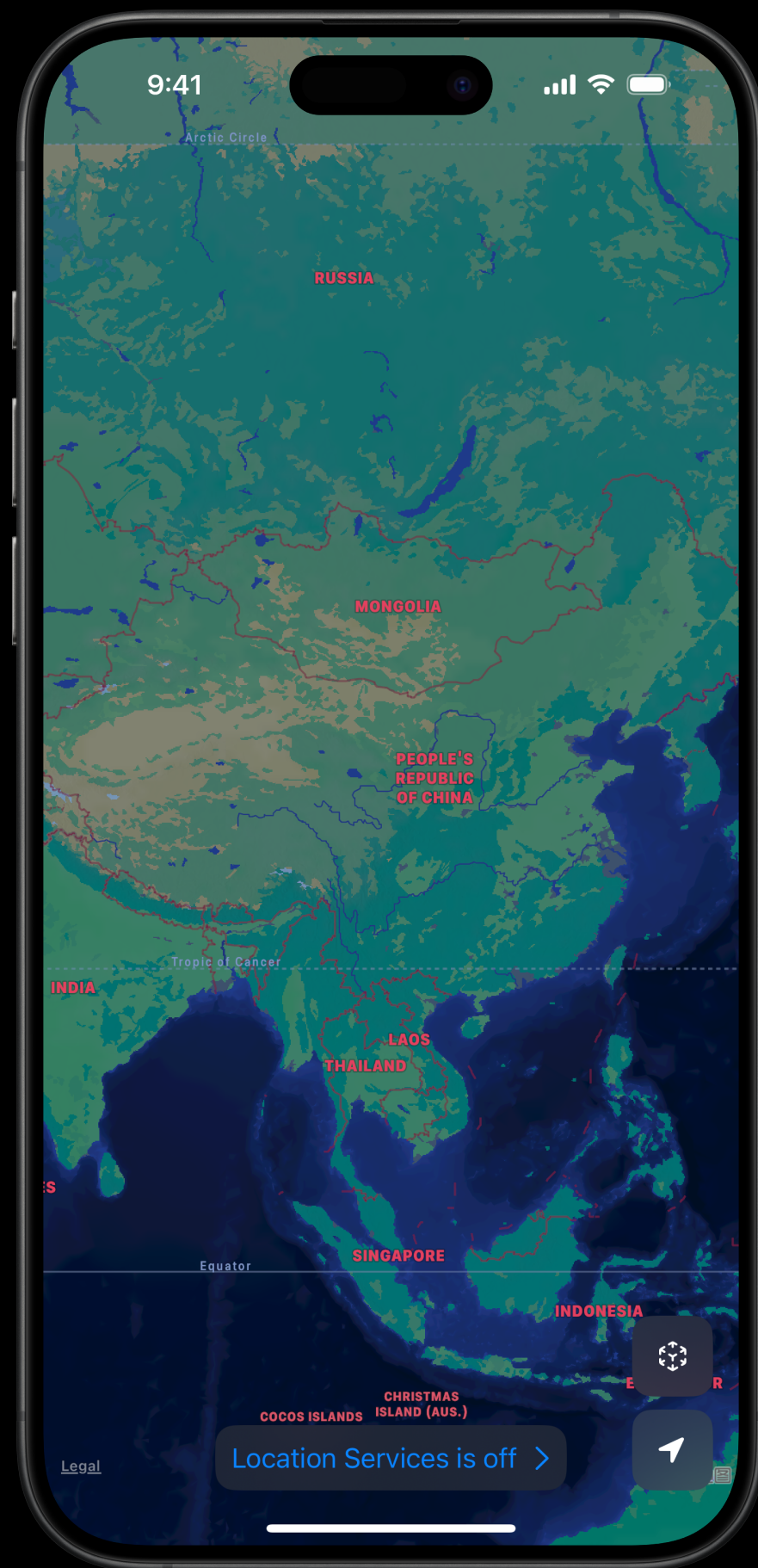
    func updateUIView(_ uiView: MKMapView, context: Context) {
    }
}
```

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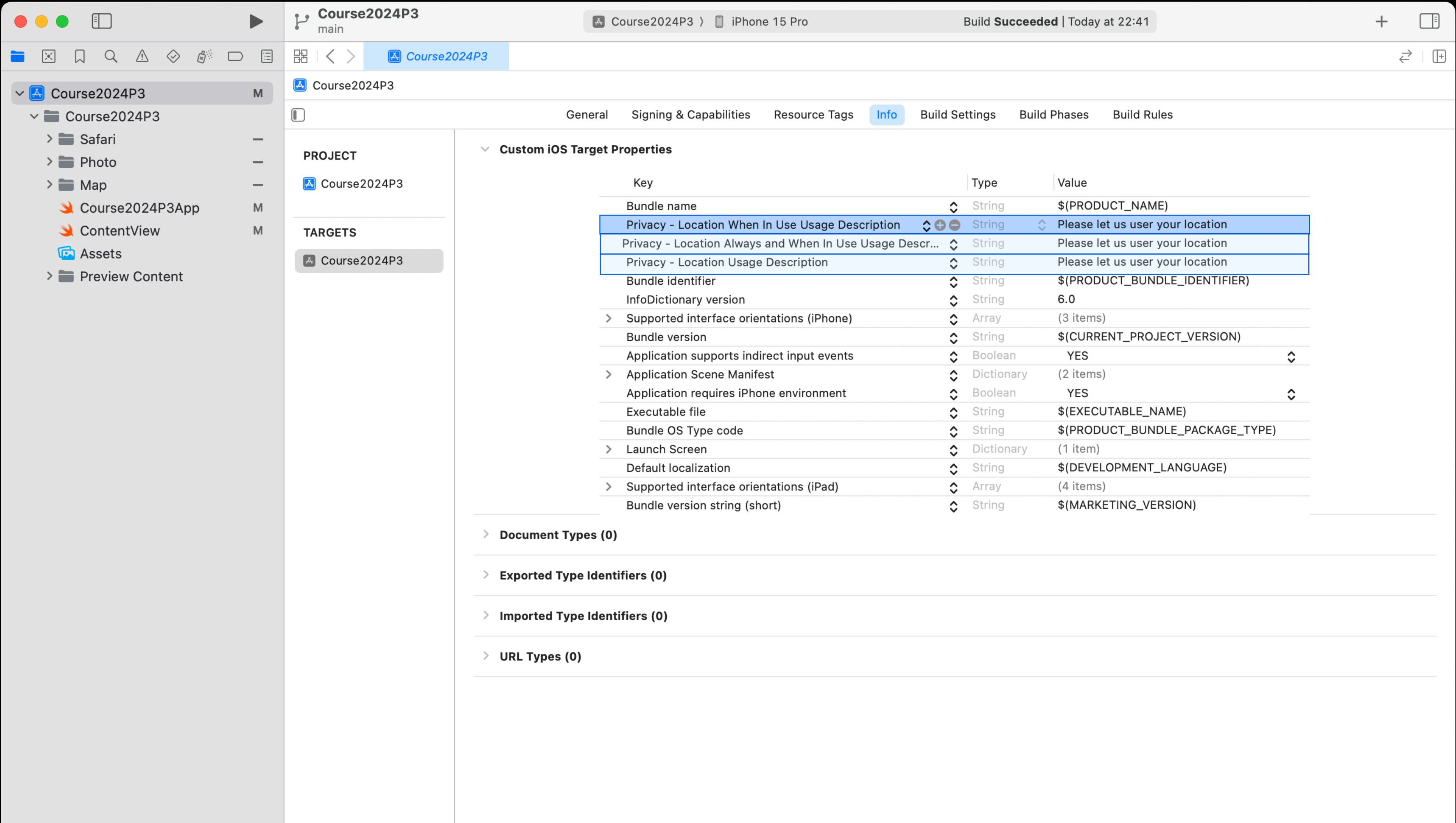
```
class MapViewModel: NSObject, ObservableObject, CLLocationManagerDelegate {  
    @Published var mapView = MKMapView()  
  
    @Published var locationManager = CLLocationManager()  
  
    override init(){  
        super.init()  
        locationManager.delegate = self  
    }  
}
```


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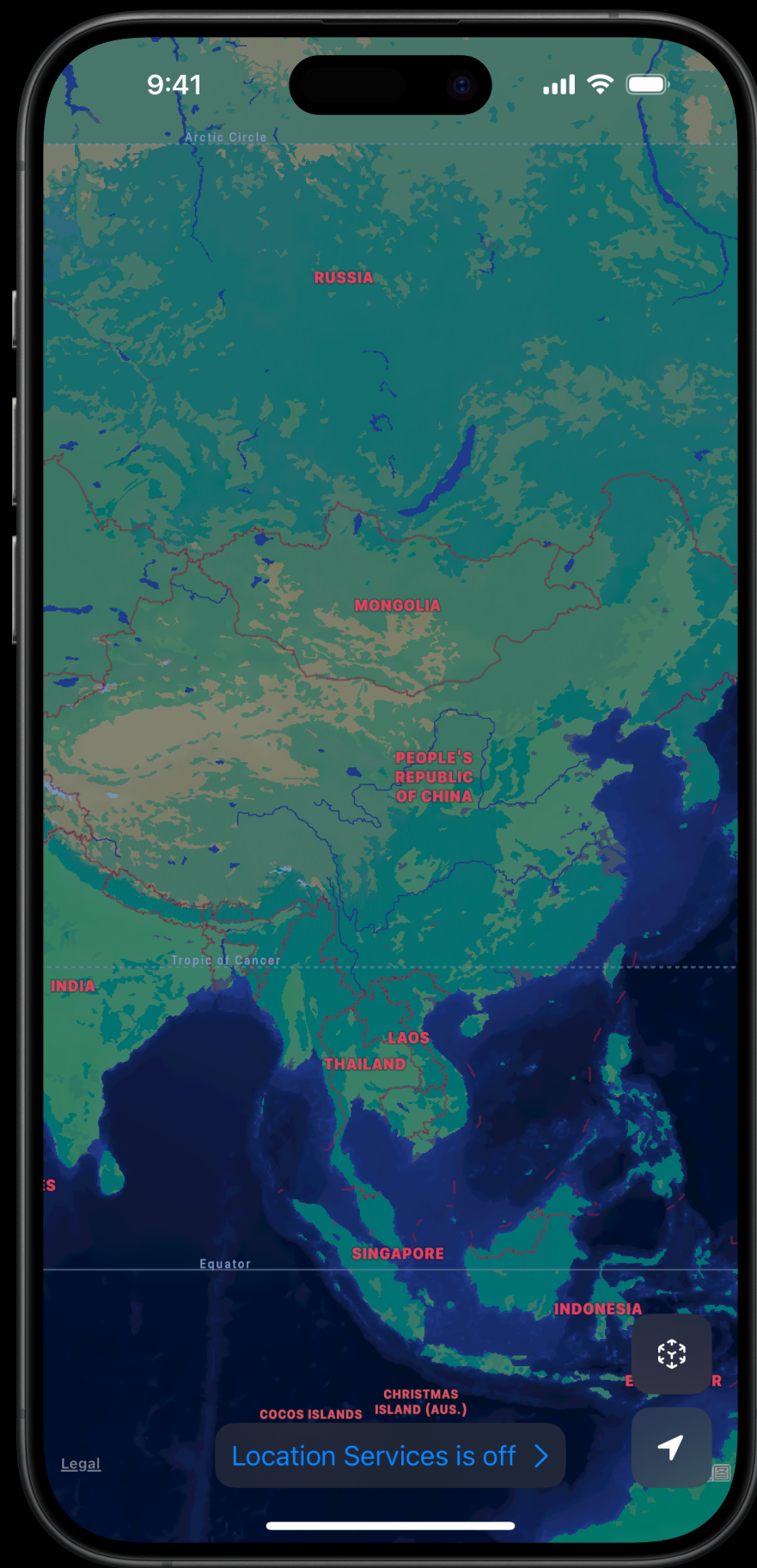
iOS应用的数据模式与

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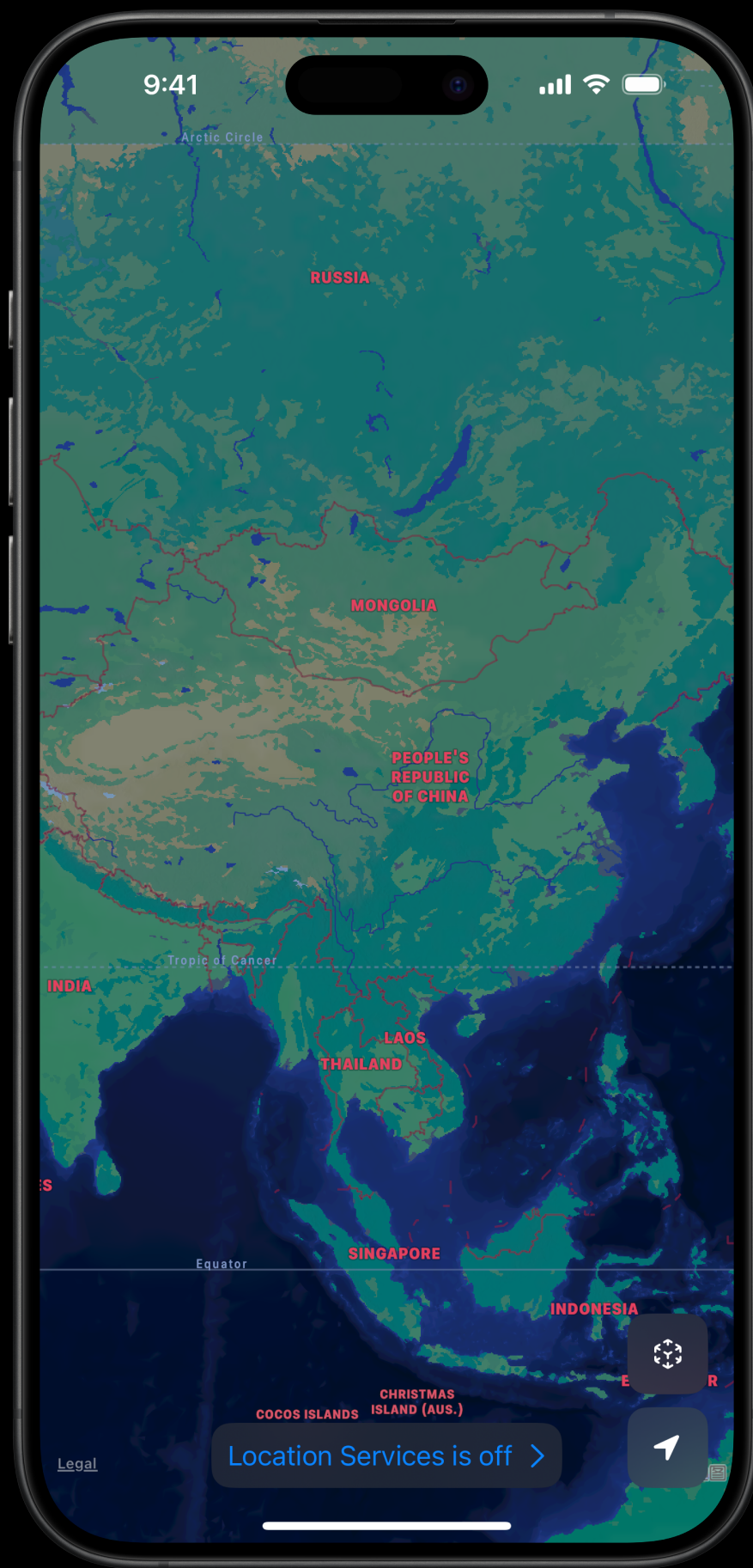
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```
class MapViewModel: NSObject, ObservableObject, CLLocationManagerDelegate{  
    @Published var mapView = MKMapView()  
    @Published var locationManager = CLLocationManager()  
  
    override init(){  
        super.init()  
        locationManager.delegate = self  
    }  
}
```

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iOS应用的数据模式与SwiftUI和UIKit交互

```
class MapViewModel: NSObject, ObservableObject, CLLocationManagerDelegate{
    @Published var mapView = MKMapView()
    @Published var locationManager = CLLocationManager()
    @Published var permissionDenied = true

    override init(){
        super.init()
        locationManager.delegate = self
    }

    func locationManagerDidChangeAuthorization(_ manager: CLLocationManager) {
        switch manager.authorizationStatus {
            case .notDetermined:
                manager.requestWhenInUseAuthorization()
            case .authorizedWhenInUse:
                manager.requestLocation()
            case .authorizedAlways:
                permissionDenied = false
            @unknown default:
                // print("Unknown error")
        }
    }
}
```


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iOS应用的数据模式与SwiftUI和UIKit交互

```
class MapViewModel: NSObject, ObservableObject, CLLocationManagerDelegate{
    @Published var mapView = MKMapView()
    @Published var locationManager = CLLocationManager()
    @Published var permissionDenied = true

    override init(){
        super.init()
        locationManager.delegate = self
    }

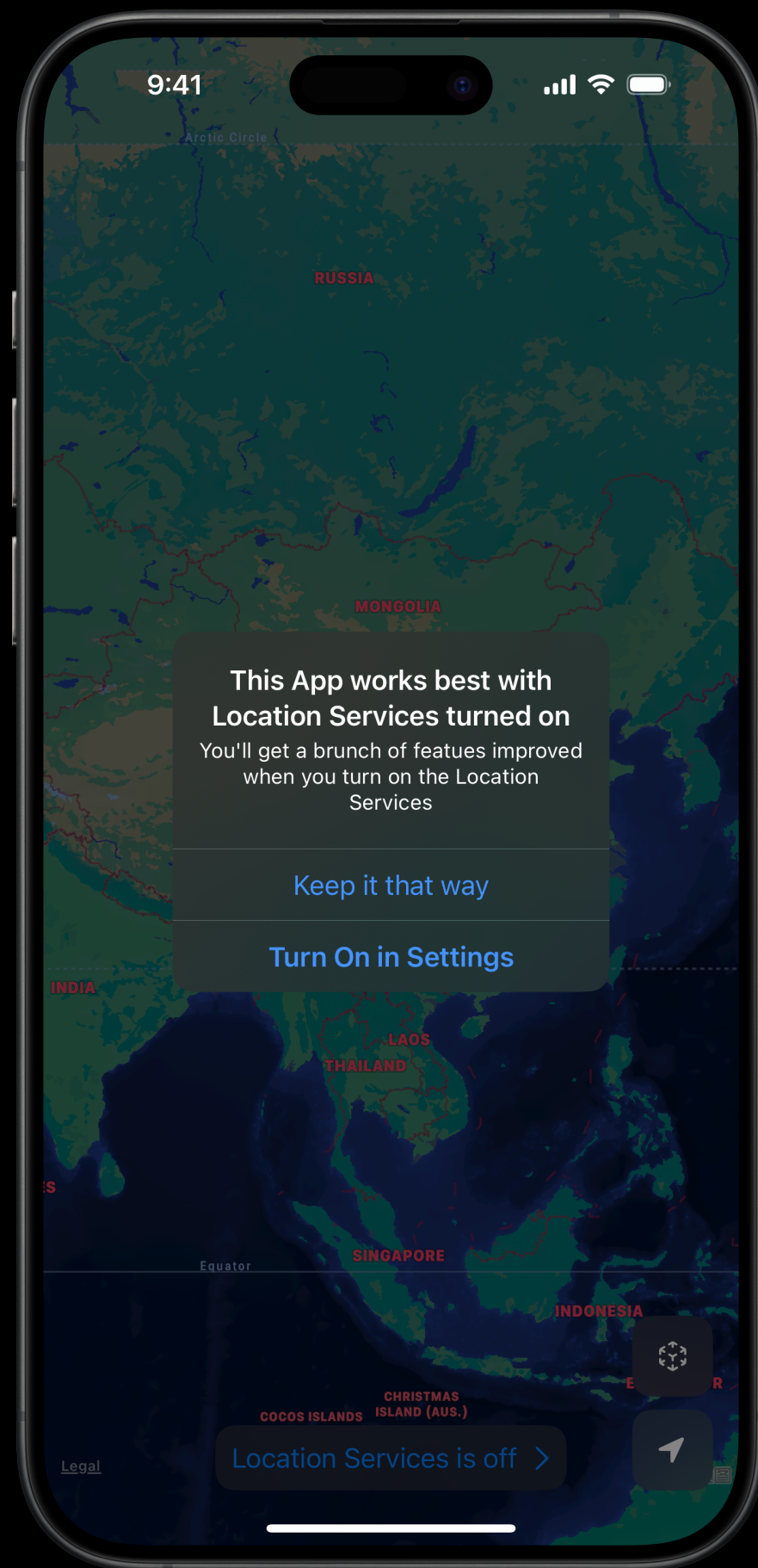
    func locationManagerDidChangeAuthorization(_ manager: CLLocationManager) {
        switch manager.authorizationStatus {
            case .notDetermined:
                manager.requestWhenInUseAuthorization()
            case .authorizedWhenInUse:
                manager.requestLocation()
            case .authorizedAlways:
                permissionDenied = false
            @unknown default:
                // print("Unknown error")
        }
    }
}
```


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Button ...

```
.alert("This App works best with Location Services turned on", isPresented: $isShowAlert){
    Button(role: .none){
    }label:{
        Text("Keep it that way")
    }
    Button(role: .cancel){
        UIApplication.shared.open(URL(string: UIApplication.openSettingsURLString)!)
    }label:{
        Text("Turn On in Settings")
    }
} message: {
    Text("You'll get a brunch of featues improved when you turn on the Location Services")
}
```

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iOS应用的数据模式与SwiftUI和UIKit交互

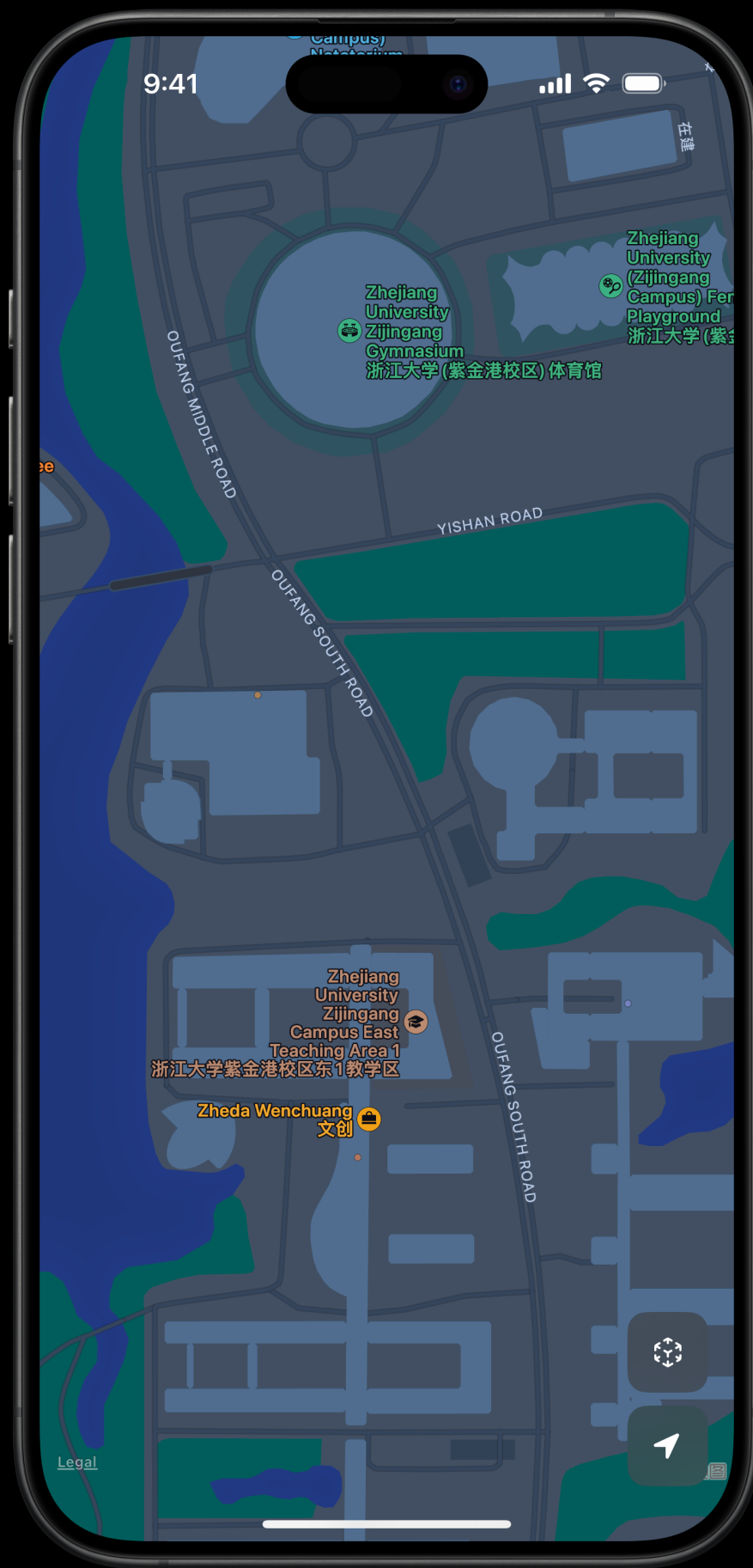
```
class MapViewModel: NSObject, ObservableObject, CLLocationManagerDelegate{
    @Published var mapView = MKMapView()
    @Published var locationManager = CLLocationManager()
    @Published var permissionDenied = true

    override init(){
        super.init()
        locationManager.delegate = self
    }

    func locationManagerDidChangeAuthorization(_ manager: CLLocationManager) {
        switch manager.authorizationStatus {
            case .notDetermined:
                manager.requestWhenInUseAuthorization()
            case .authorizedWhenInUse:
                manager.requestLocation()
            case .authorizedAlways:
                permissionDenied = false
            @unknown default:
                // print("Unknown error")
        }
    }
}
```


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```
@Published var region: MKCoordinateRegion!
```

```
func locationManager(_ manager: CLLocationManager,
                    didFinishWithError error: Error) {
    print(error.localizedDescription)
}
```

```
func locationManager(_ manager: CLLocationManager,
                    didUpdateLocations locations: [CLLocation]){
    guard let location = locations.last else { return }
    self.region = MKCoordinateRegion(center: location2D,
                                    span: MKCoordinateSpan(latitudeDelta: 0.2,
                                                            longitudeDelta: 0.2))

    self.mapView.setRegion(self.region, animated: true)
    self.mapView.setVisibleMapRect(self.mapView.visibleMapRect, animated: true)
}
```

```
}
```


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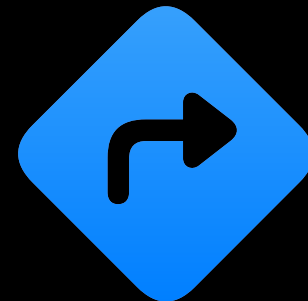


Search



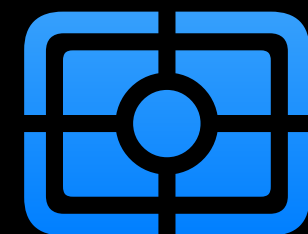
Annotations

Direction



Geocoding

Snapshots



Selectable



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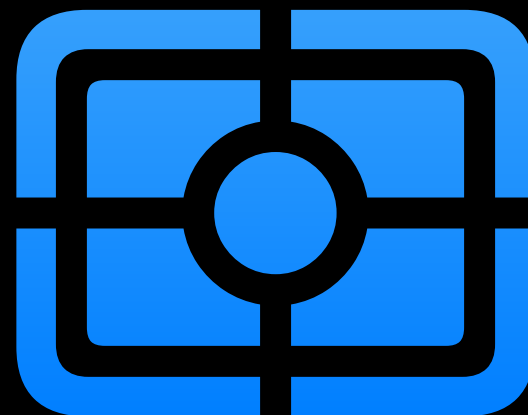
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Annotations



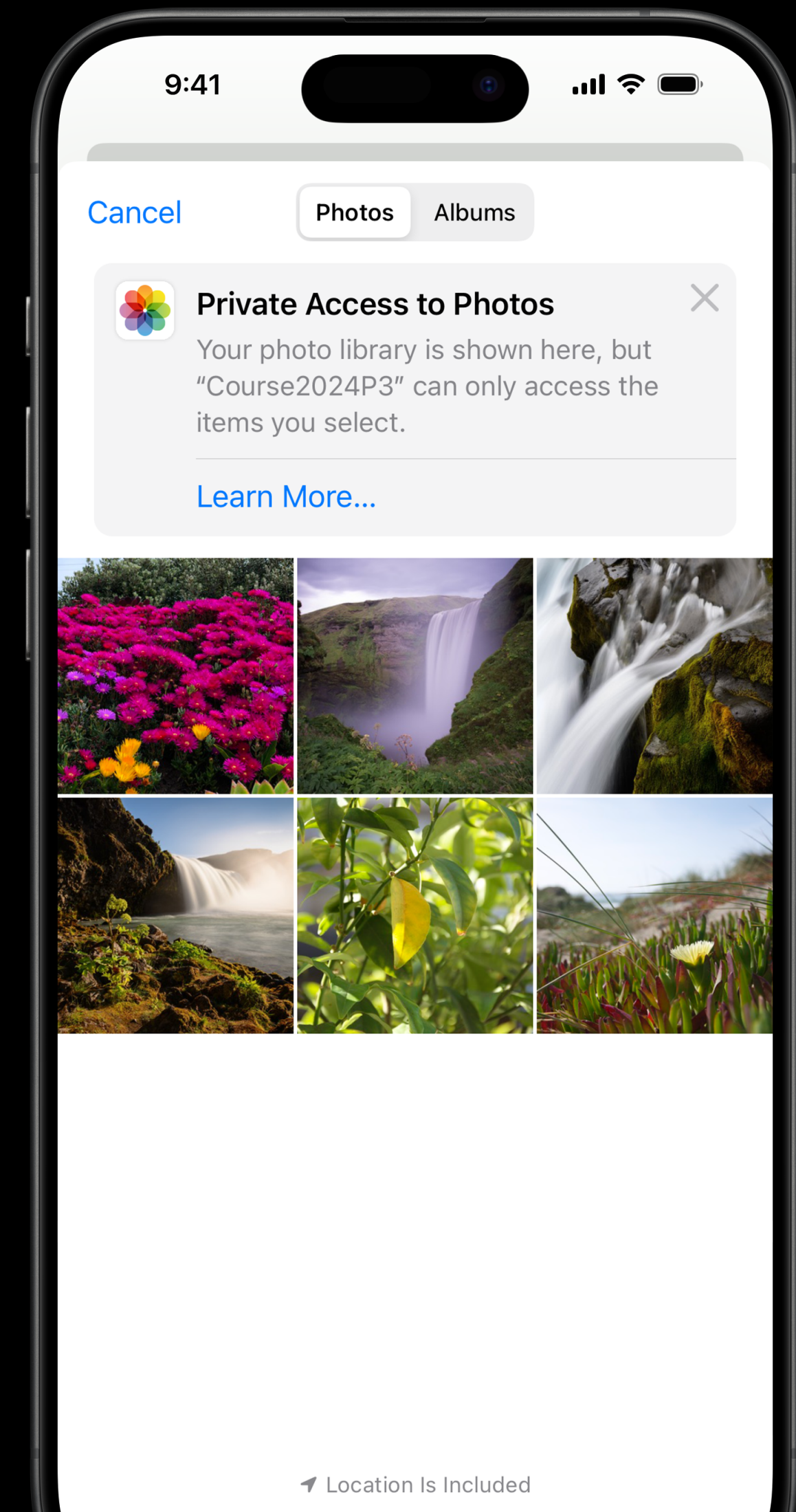
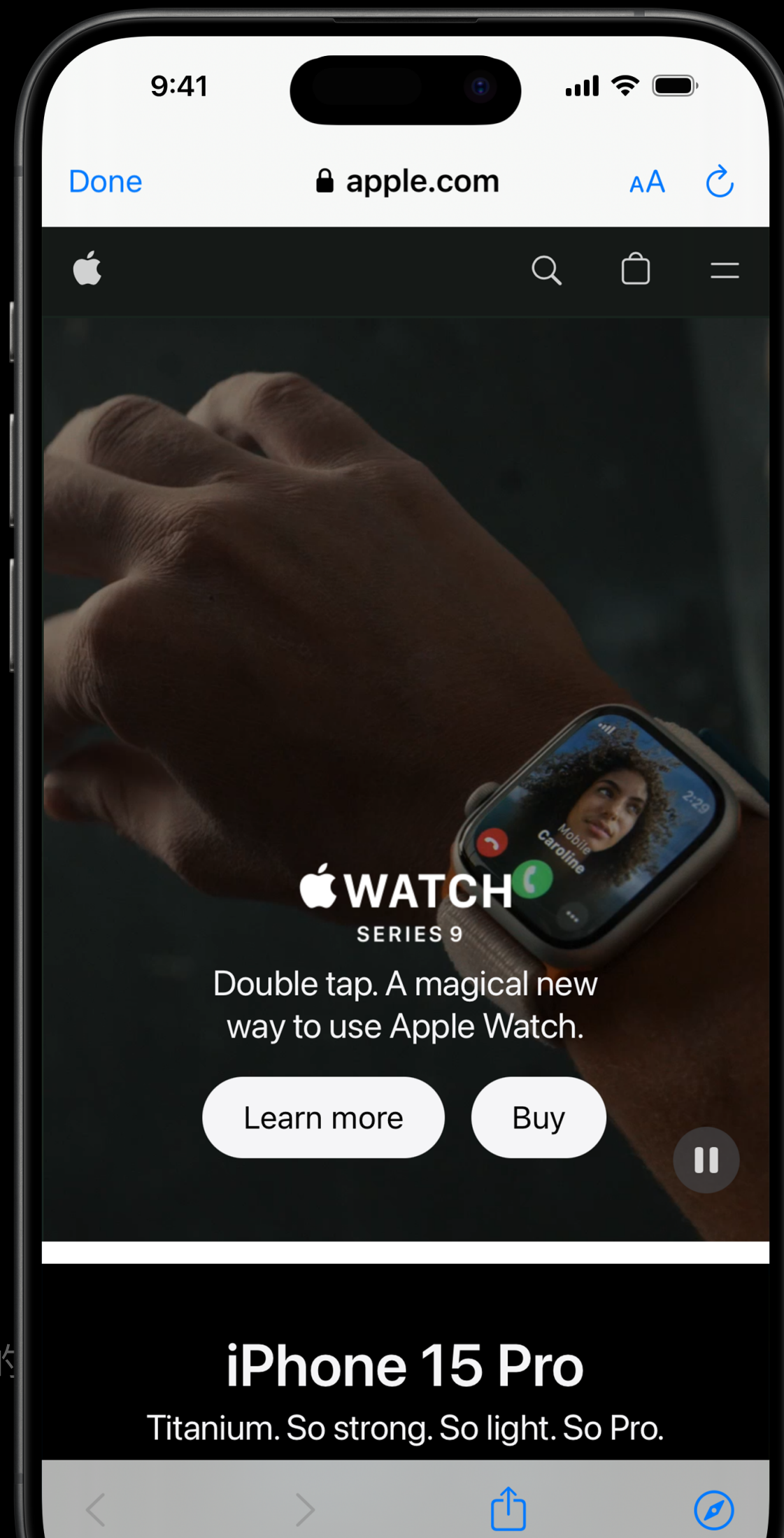
Snapshots



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iOS应用的

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```
struct NewMapView: View {
    @State var position: MapCameraPosition =
        .camera(MapCamera(centerCoordinate: .meetingPoint,
                           distance: 300,
                           pitch: 30))

    var body: some View {
        Map(position: $position){
            Marker("Meeting Point", coordinate: .meetingPoint)
        }
        .mapStyle(.standard(elevation: .realistic))
    }
}

extension CLLocationCoordinate2D{
    static let meetingPoint = CLLocationCoordinate2D(latitude: 42.3528,
                                                       longitude: -71.068369)
}
```

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WWDC 23: <https://developer.apple.com/videos/play/wwdc2023/10043/>

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Any Questions ?