



# SwiftUI at Scale

Richard Topchii

**What is “at scale”?**

**What is “at scale”?**

# What is “at scale”?



**>1B devices**

# What is “at scale”?



**>1B devices**

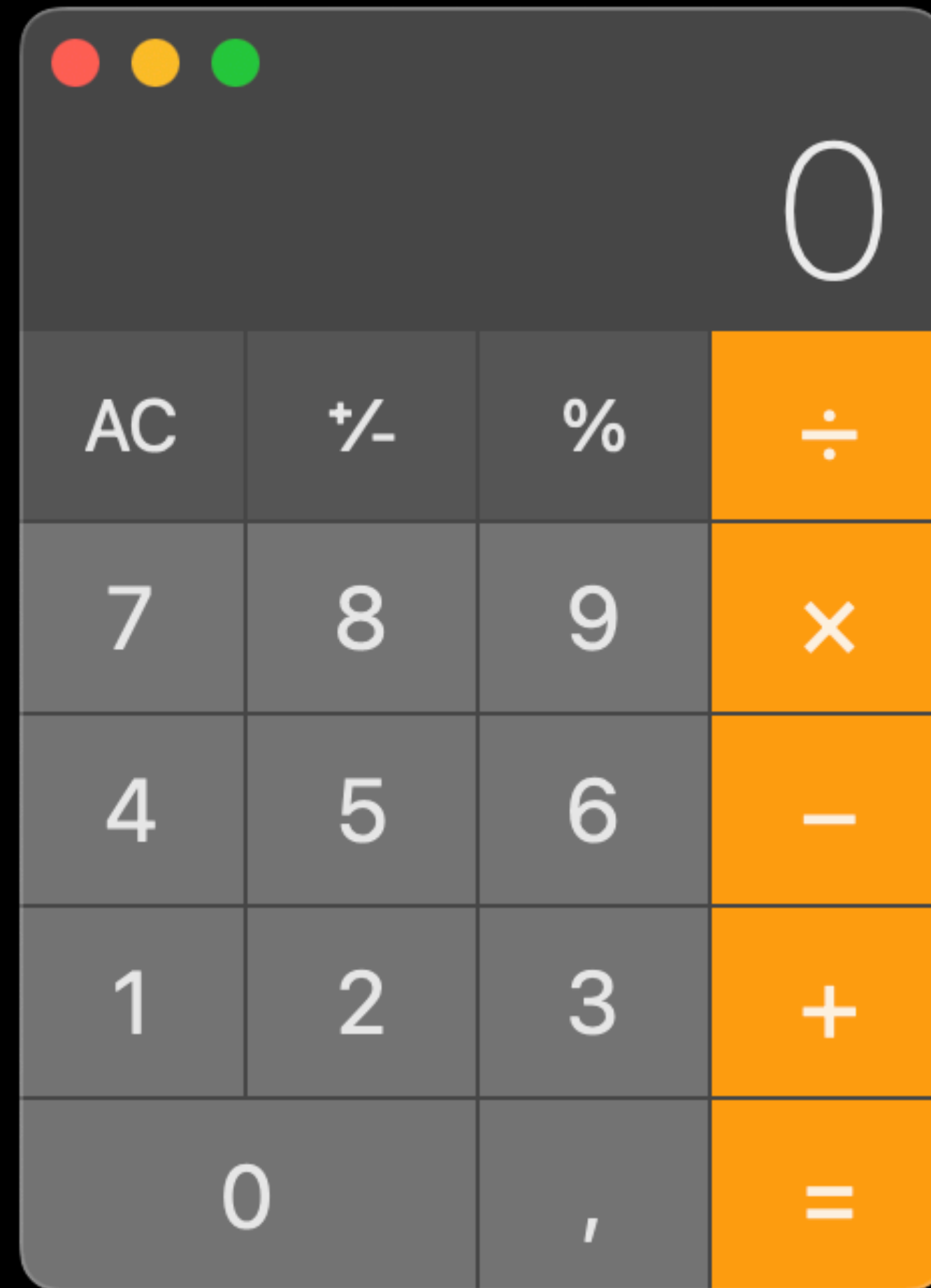


**Important decisions**

**1**

**Day to develop**

# “The App”



**A different scale**

**A different scale**

**Multiple developers work with  
multiple code bases**



15.17

4G 100

FS Protection



Your action is required



Safe Browsing extension  
for Safari



It only takes one minute to start  
protecting yourself from  
fraudulent websites on Safari

Set up

MY PROTECTION



Privacy VPN  
OFF



Safe Browsing



Password Vault



ID Monitoring

ALL PROTECTION



People & Devices

# FS Protection App

15.17

4G 100

FS Protection



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OFF



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ALL PROTECTION

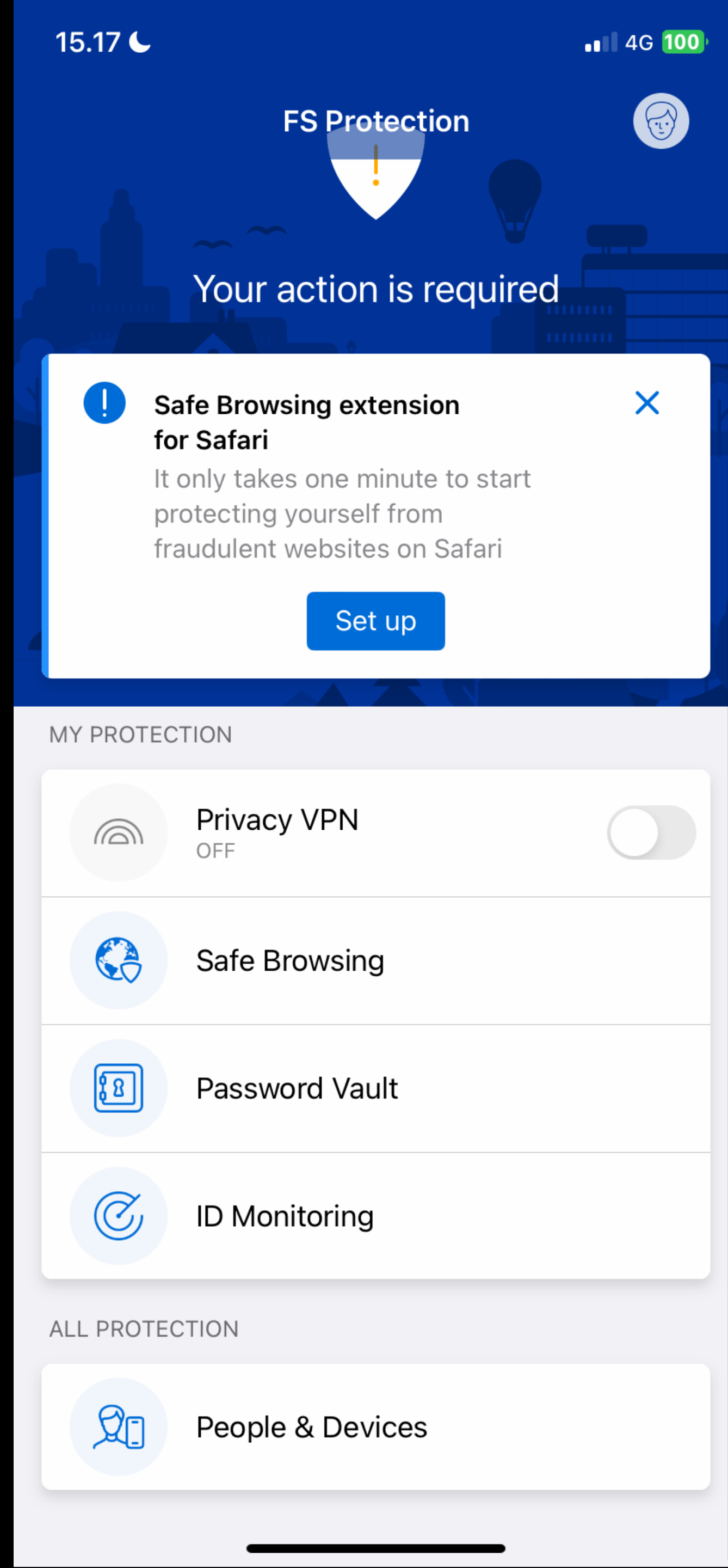


People & Devices

# FS Protection App

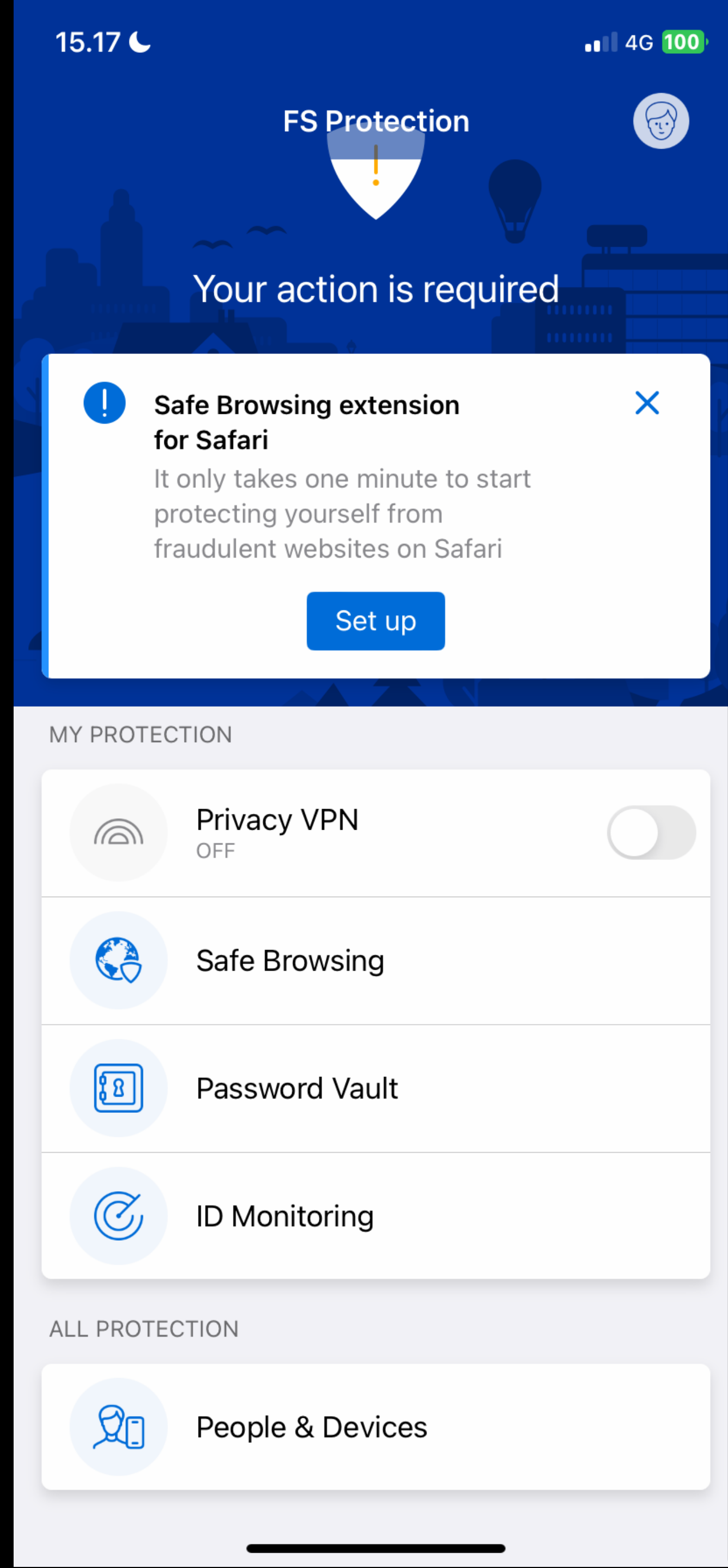
- **SuperApp**

# FS Protection App



- **SuperApp**
- **Modular architecture**

# FS Protection App



- **SuperApp**
- **Modular architecture**
- **Shared code with Mac**



15.17

4G 100

FS Protection



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People & Devices

# FS Protection App

# Password Vault

# FS Protection




Your action is required

## ! Safe Browsing extension for Safari ✕


It only takes one minute to start protecting yourself from fraudulent websites on Safari

Set up

### MY PROTECTION


 Privacy VPN  
OFF

 Safe Browsing

 Password Vault

 ID Monitoring

### ALL PROTECTION

 People & Devices



Your action is required

! Safe Browsing extension for Safari

It only takes one minute to start protecting yourself from fraudulent websites on Safari

Set up

MY PROTECTION

Privacy VPN OFF

Safe Browsing

Password Vault

ID Monitoring

ALL PROTECTION

People & Devices



Master Password

Use Face ID to unlock

Unlock

Unlock with Face ID

Forgot Master Password?





Your action is required

! Safe Browsing extension for Safari

It only takes one minute to start protecting yourself from fraudulent websites on Safari

Set up

MY PROTECTION

Privacy VPN OFF

Safe Browsing

Password Vault

ID Monitoring

ALL PROTECTION

People & Devices



Master Password



Use Face ID to unlock



Unlock

Unlock with Face ID

Forgot Master Password?



! Create a Recovery QR Code

In case you forget your Master Password, you can access your Vault with this code.

Create

Search

ALL ENTRIES (16):

+ Add

Bs Bsjsxkmx

Ccc

HM he Municipal Council (Conseil mu... he Municipal Council (Conseil municipal) hold...

Pa Password usename

Ro Roche abc def ghi jkl mno pqrs tuv wxyz ABC DEF G...

Te Test user

TC The city of Geneva (ville de Genève... The city of Geneva (ville de Geneve) had a po...



Your action is required

**! Safe Browsing extension for Safari** ✕

It only takes one minute to start protecting yourself from fraudulent websites on Safari

[Set up](#)

MY PROTECTION

- Privacy VPN OFF
- Safe Browsing
- Password Vault
- ID Monitoring

ALL PROTECTION

- People & Devices



Master Password

Use Face ID to unlock

Unlock

Unlock with Face ID

[Forgot Master Password?](#)

**! Create a Recovery QR Code**

In case you forget your Master Password, you can access your Vault with this code.

[Create](#)

Search

ALL ENTRIES (16): [+ Add](#)

- Bsjskmx
- Ccc
- he Municipal Council (Conseil mu...  
he Municipal Council (Conseil municipal) hold...
- Password  
usenane
- Roche  
abc def ghi jkl mno pqrstu vwxyz ABC DEF G...
- Test  
user
- The city of Geneva (ville de Genève...  
The city of Geneva (ville de Geneve) had a po...

**! Create a Recovery QR Code**

In case you forget your Master Password, you can access your Vault with this code.

[Create](#)

Search

ALL ENTRIES (16): [+ Add](#)


- Bsjskmx
- Ccc
- he Municipal Council (Conseil mu...  
he Municipal Council (Conseil municipal) hold...
- Password

Add new

- Password
- Credit card

15.18 4G 100

# Password Vault



Master Password

Use Face ID to unlock

Unlock

Unlock with Face ID

Forgot Master Password?

15.18 4G 100

Back Password Vault

**!** Create a Recovery QR Code  
In case you forget your Master Password, you can access your Vault with this code.

Create

Search

ALL ENTRIES (16): [+ Add](#)

- Bs** Bsjaxmx
- Ccc** Ccc
- HM** he Municipal Council (Conseil mu...  
he Municipal Council (Conseil municipal) hold...
- Pa** Password  
username
- Ro** Roche  
abc def ghi jkl mno pqr stu vwx yz ABC DEF G...
- Te** Test  
user
- TC** The city of Geneva (ville de Genève...  
The city of Geneva (ville de Geneve) had a po...

15.18 4G 100

Back Password Vault

**!** Create a Recovery QR Code  
In case you forget your Master Password, you can access your Vault with this code.

Create

Search

ALL ENTRIES (16): [+ Add](#)

- Bs** Bsjaxmx
- Ccc** Ccc
- HM** he Municipal Council (Conseil mu...  
he Municipal Council (Conseil municipal) hold...
- Pa** Password

**Add new**

Password Credit card

15.18 4G 100

Cancel Add Credit Card Save

**Credit**

Edit

Cardholder

PIN

Expiry date

Verification code

Web address

Notes

15.18 4G 100

Password Vault

Create a Recovery QR Code  
In case you forget your Master Password, you can access your Vault with this code.

Create

Search

ENTRIES (16): + Add

Bsjxkmx

Ccc

he Municipal Council (Conseil mu...)  
he Municipal Council (Conseil municipal) hold...

Password  
usenane

Roche  
abc def ghi jkl mno pqrs tuv wxyz ABC DEF G...

Test  
user

The city of Geneva (ville de Genève...)  
The city of Geneva (ville de Geneve) had a po...

15.18 4G 100

Back Password Vault

Create a Recovery QR Code  
In case you forget your Master Password, you can access your Vault with this code.

Create

Search

ALL ENTRIES (16): + Add

Bs Bsjxkmx

Ccc

HM he Municipal Council (Conseil mu...)  
he Municipal Council (Conseil municipal) hold...

Pa Password

Add new

Password Credit card

15.18 4G 100

Cancel Add Credit Card Save

Credit

Edit

Cardholder

PIN

Expiry date

Verification code

Web address

Notes

15.18 4G 100

Back Edit

Credit

Cardholder name  
Cardholder

Credit card number  
●●●●●●●●●●●●●●●●

New entry added!



Password Vault

Create a Recovery QR Code  
In case you forget your Master Password, you can access your Vault with this code.

Create

Search

Series (16):

+ Add

Bsjxkmx

Ccc

The Municipal Council (Conseil mu...  
The Municipal Council (Conseil municipal) hold...

Password

New

Word

Credit card

15.18

Cancel Add Credit Card Save

Credit

Edit

Cardholder

Credit card icon

PIN

Expiry date

Verification code

Web address

Notes

15.18

Edit

Credit

Cardholder name  
Cardholder

Credit card number

New entry added!

15.18

Customize icon Update

Credit card icon

Color:

Symbol/Icon:

Grid of various icons including logos like Amazon, Apple, Facebook, etc.





# Sign in

to continue to Gmail

Email or phone

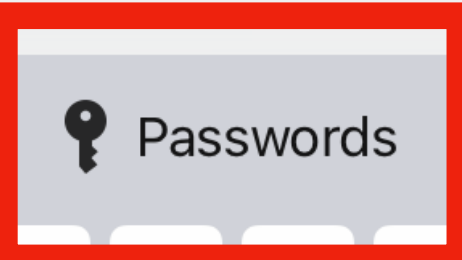
[Forgot email?](#)

Not your computer? Use Private Browsing windows to sign in. [Learn more](#)

[Create account](#)

Next

Done



q w e r t y u i o p  
a s d f g h j k l  
↑ z x c v b n m ↵  
123 😊 space @ . return





Sign in

to continue to Gmail

Email or phone

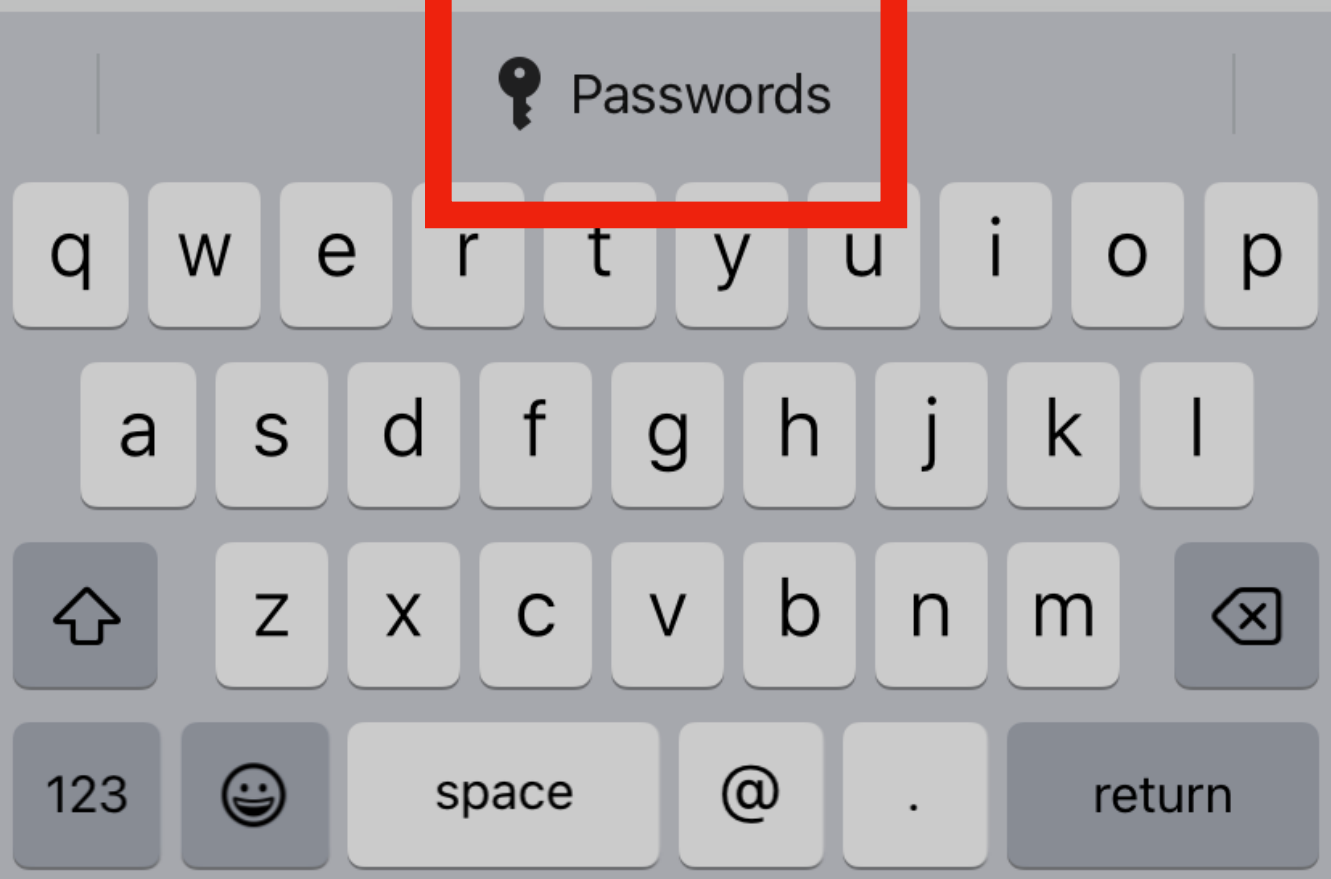
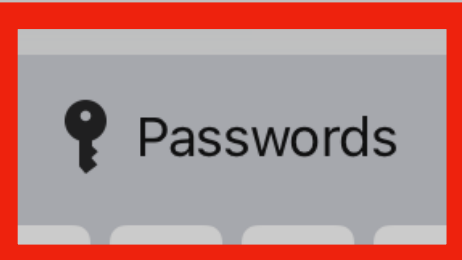
Forgot email?

Not your computer? Use Private Browsing windows to sign in. Learn more

Create account

Next

Done



Cancel Password Vault

Search

SUGGESTED:

Gmail testuser

ALL ENTRIES (17):

Bs Bsjxkmx

Ccc

Gmail testuser

he Municipal Council (Conseil municipal)...

Password usenane

Roche abc def ghi jkl mno pqrs tuv wxyz ABC DEF GHI JKL MN...

Test user





Sign in

to continue to Gmail

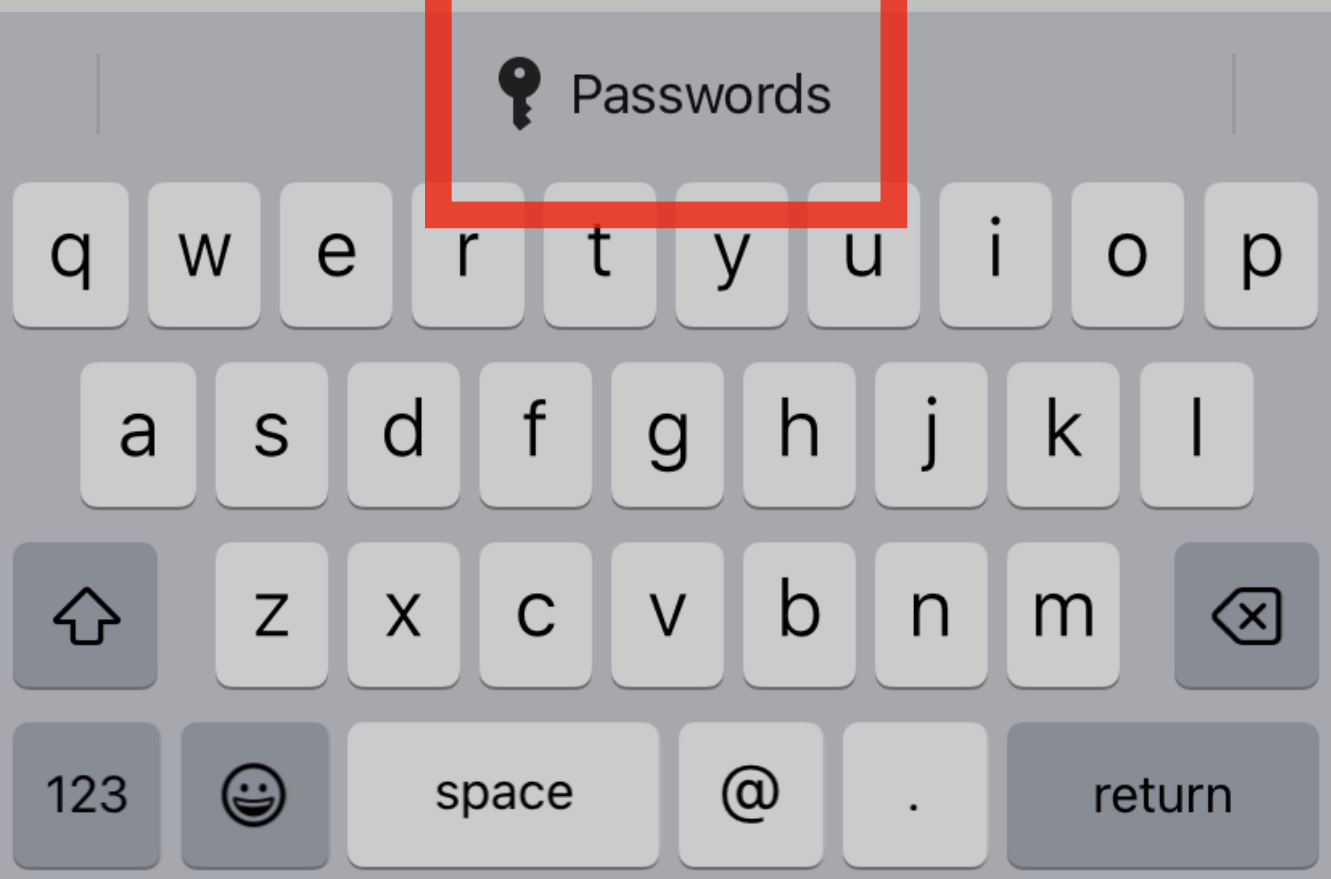
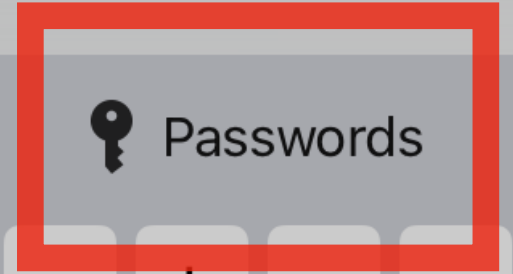
Email or phone

Forgot email?

Not your computer? Use Private Browsing windows to sign in. Learn more

Create account Next

Done



Cancel Password Vault Search

SUGGESTED:

Gmail testuser

ALL ENTRIES (17):

Bs Bsjxkmx

Ccc

Gmail testuser

he Municipal Council (Conseil municipal)...

Password usenane

Roche abc def ghi jkl mno pqrs tuv wxyz ABC DEF GHI JKL MN...

Test user



Sign in

to continue to Gmail

Email or phone testuser

Forgot email?

Not your computer? Use Private Browsing windows to sign in. Learn more

Create account Next



# SwiftUI Tips

# SwiftUI Tips

# SwiftUI Tips



**Preview Crashed**

# Healthy Previews

# Healthy Previews

# Healthy Previews

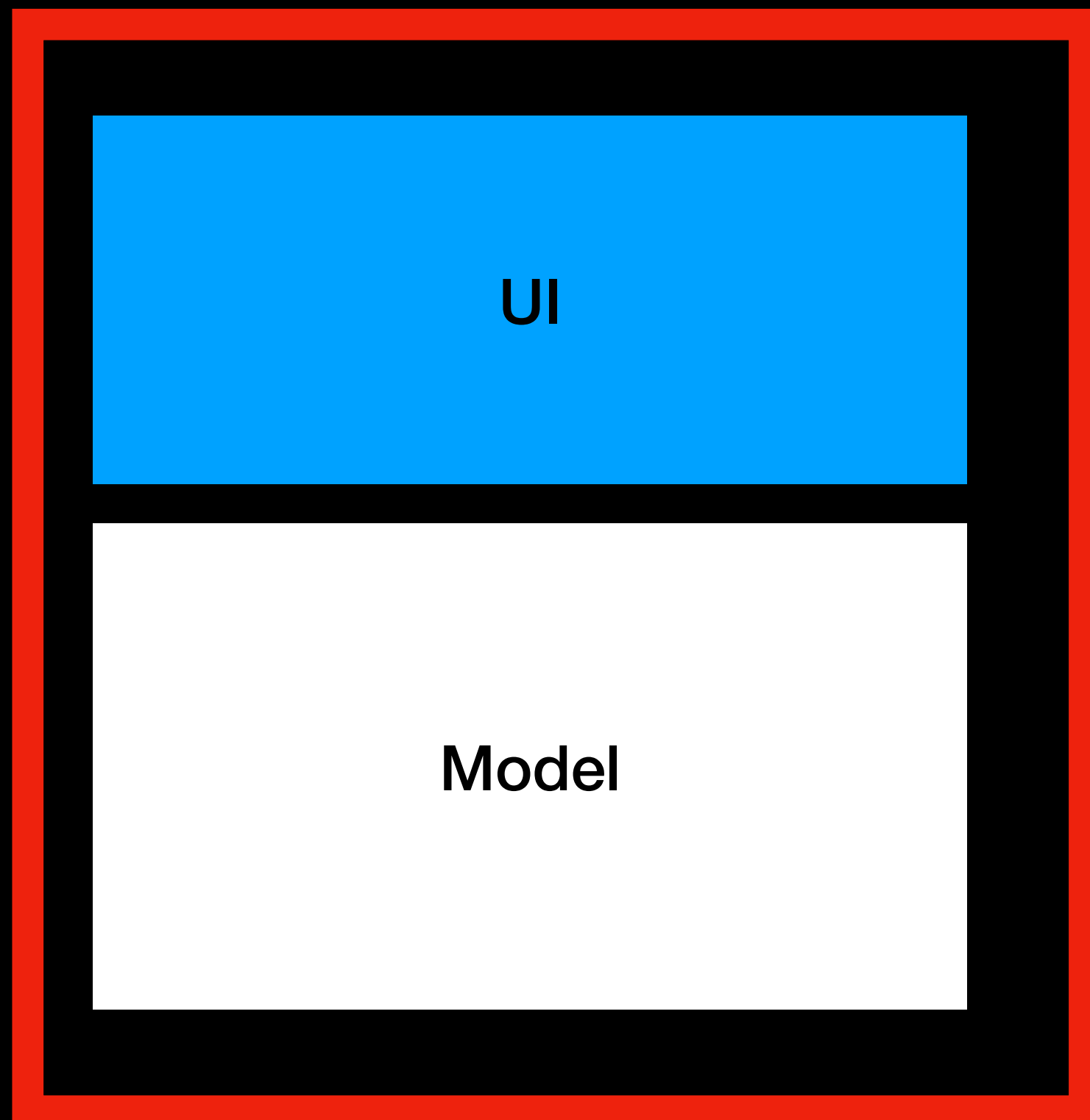
## Preview Crashes when...

- The project is too big
- Build takes too long
- Runtime error due to side effects

# Healthy Previews

## Separating UI from the Model

“Normal” app



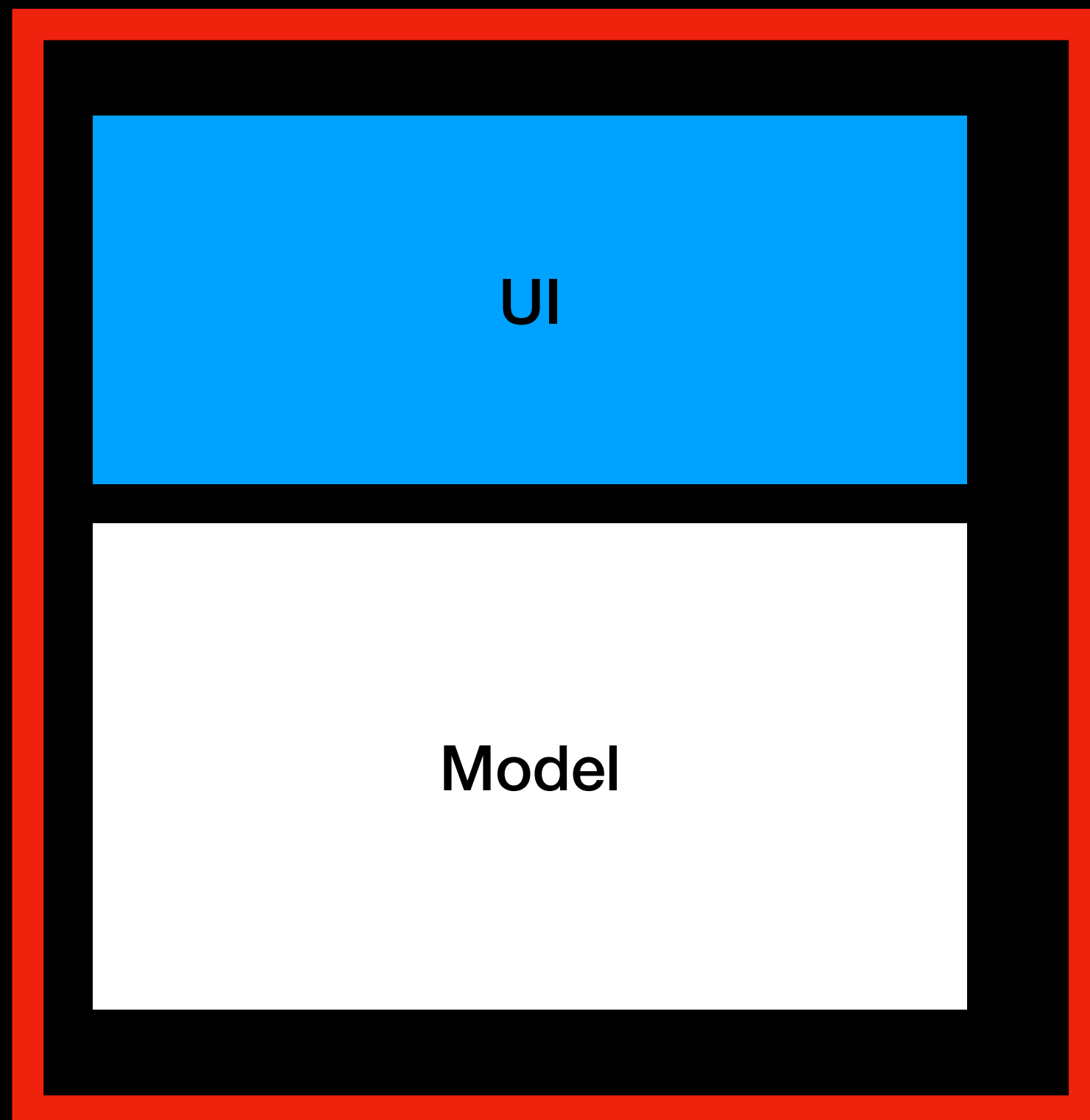
One target



# Healthy Previews

## Separating UI from the Model

“Normal” app

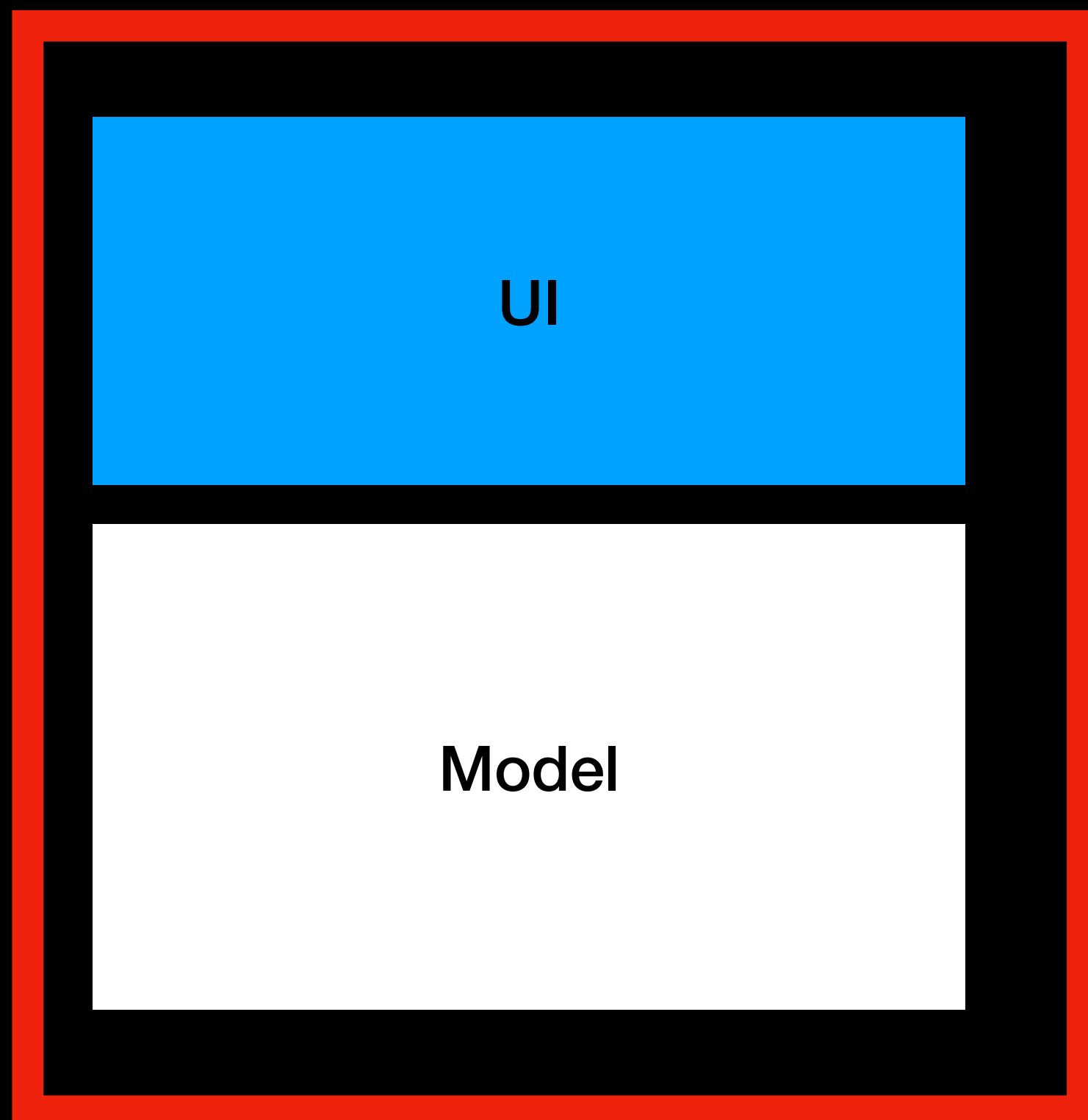


SwiftUI-Optimized

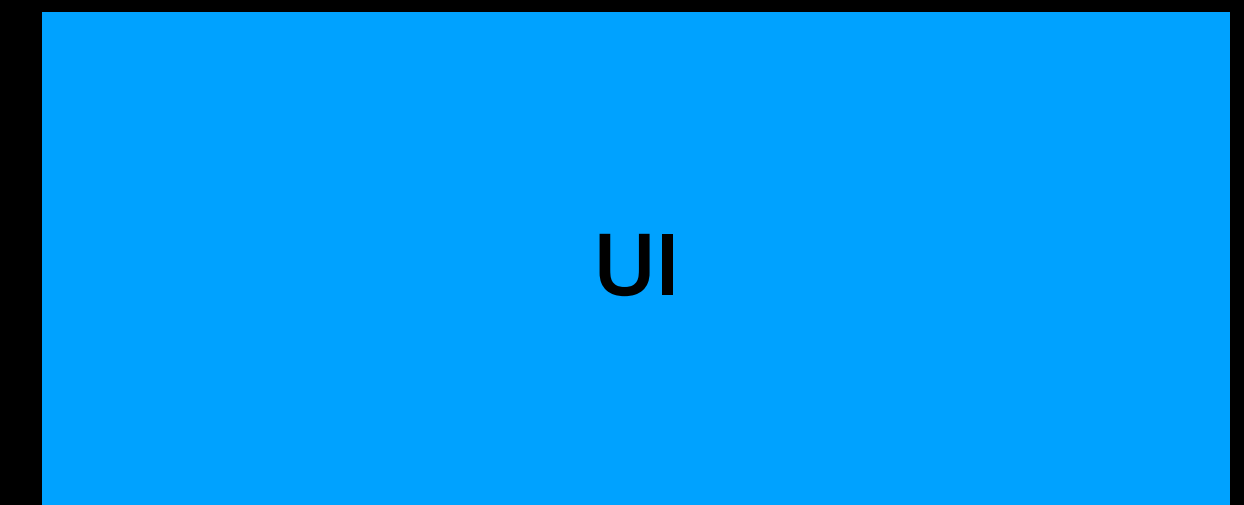
# Healthy Previews

## Separating UI from the Model

“Normal” app



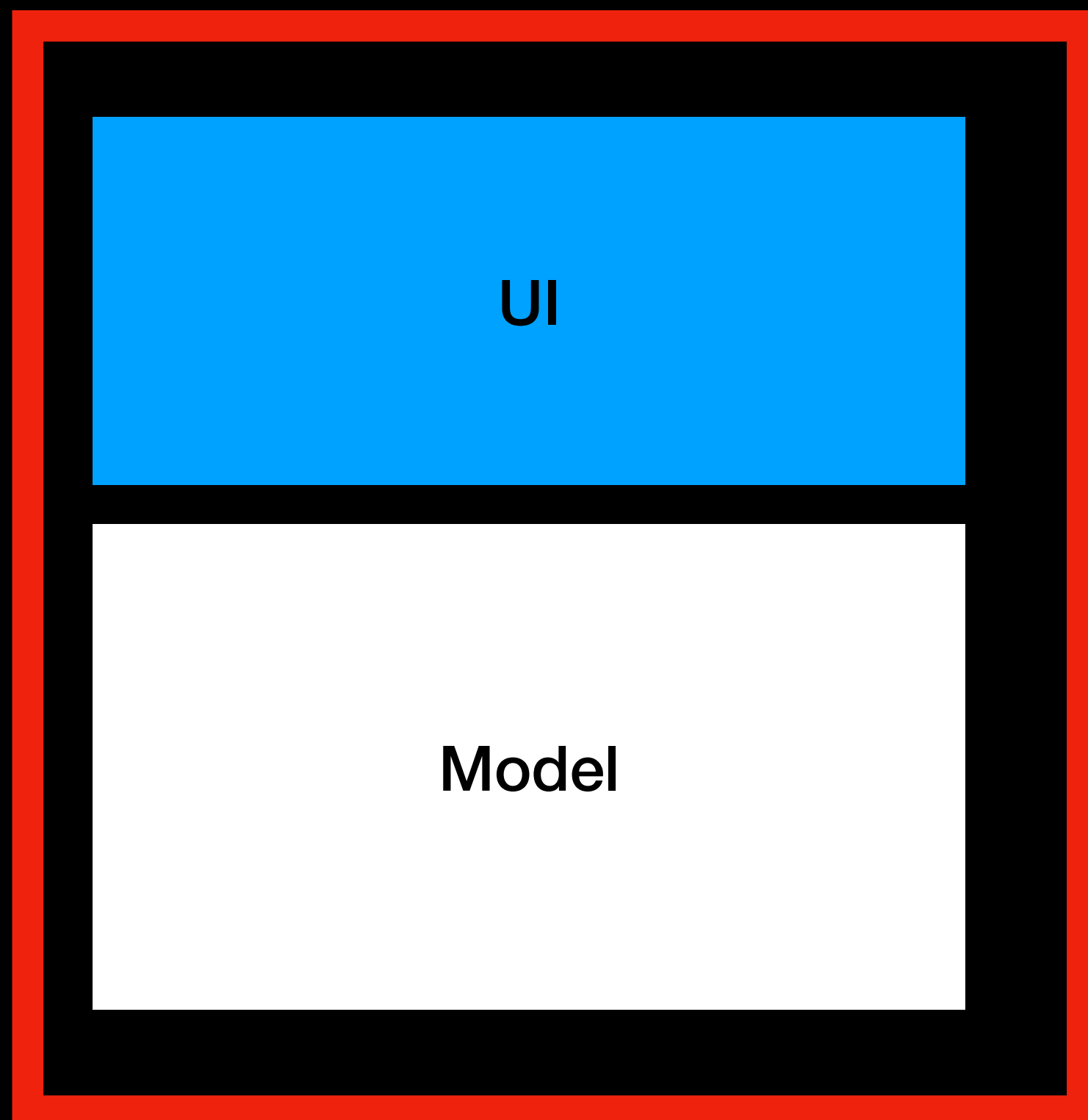
SwiftUI-Optimized



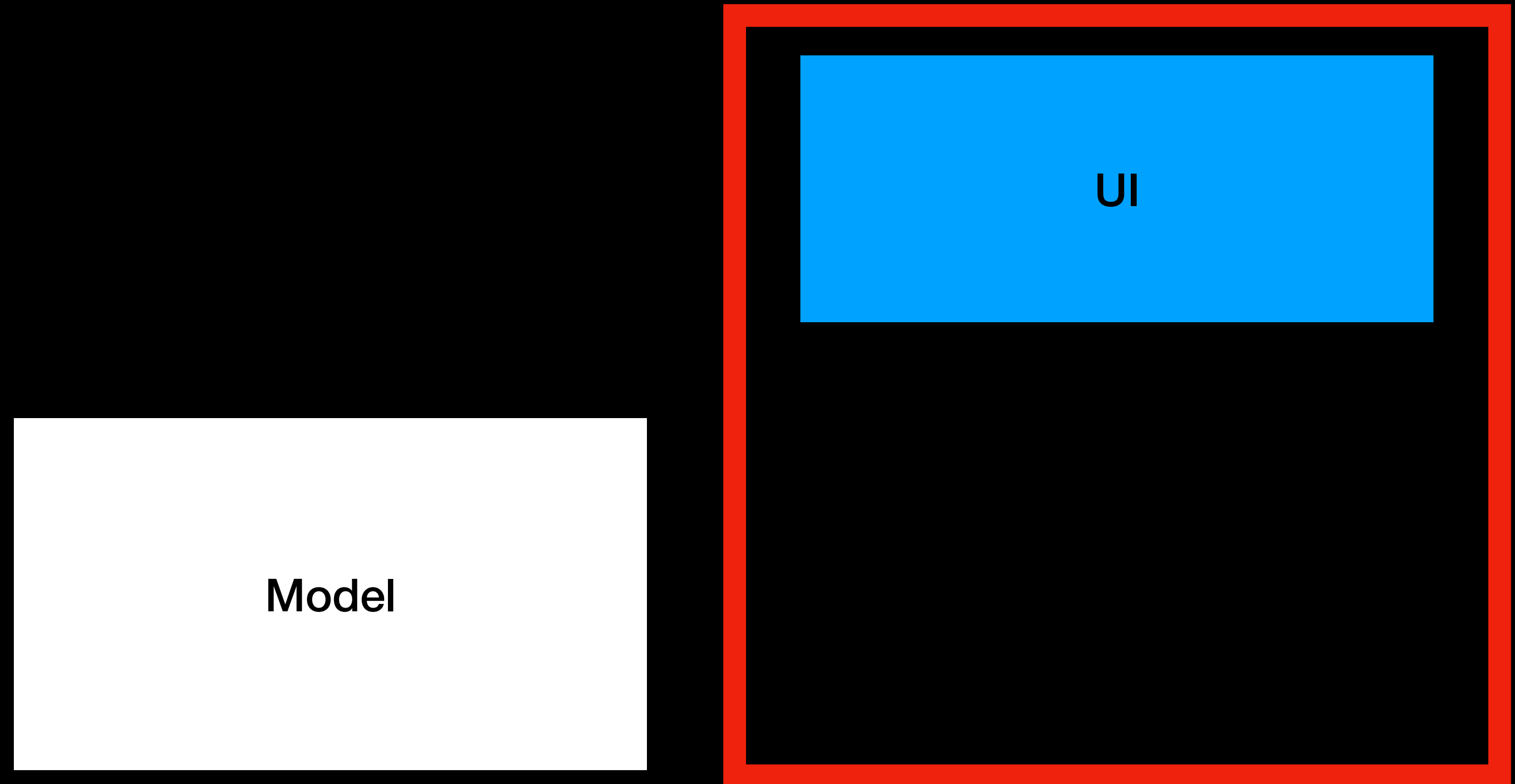
# Healthy Previews

## Separating UI from the Model

“Normal” app



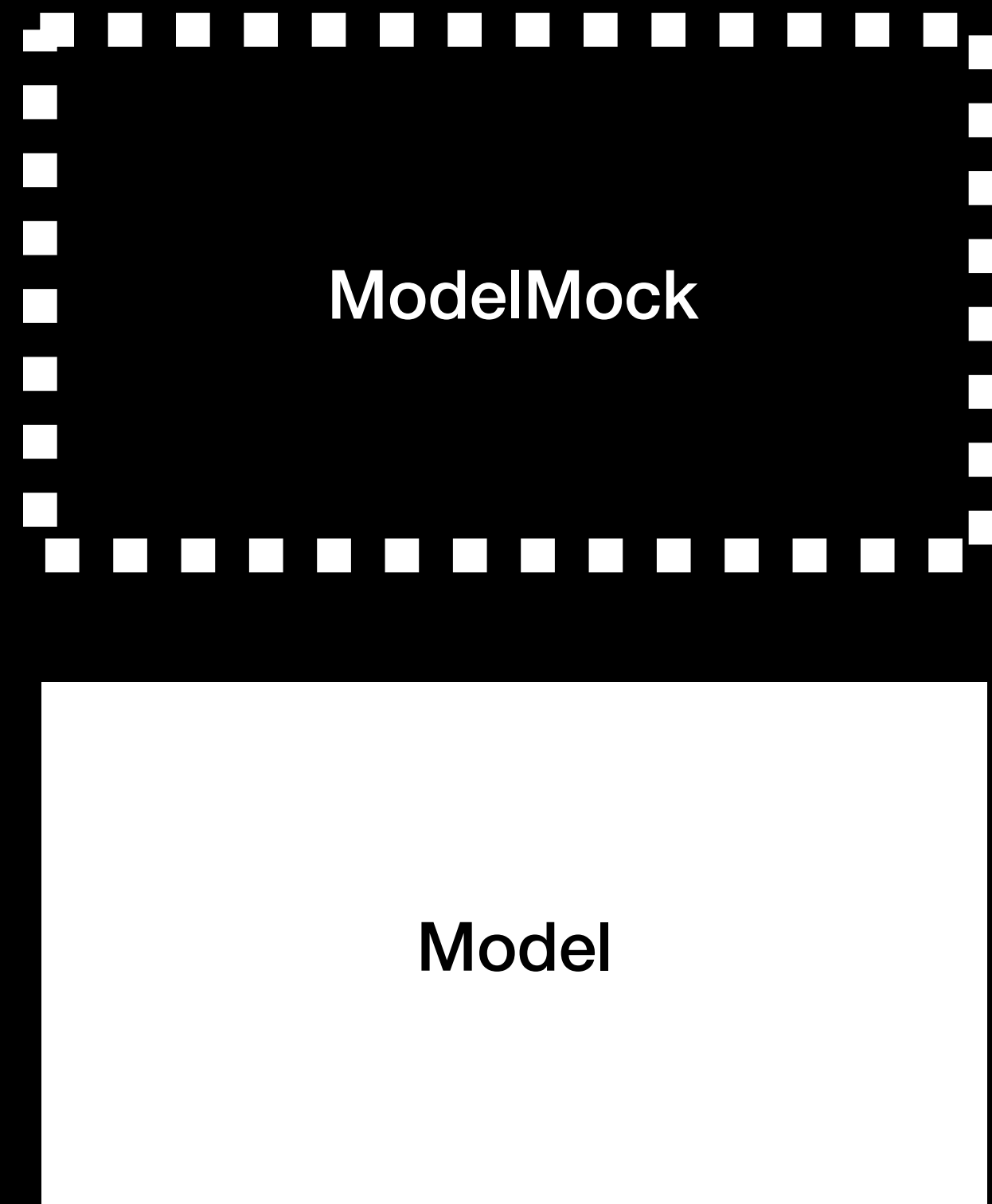
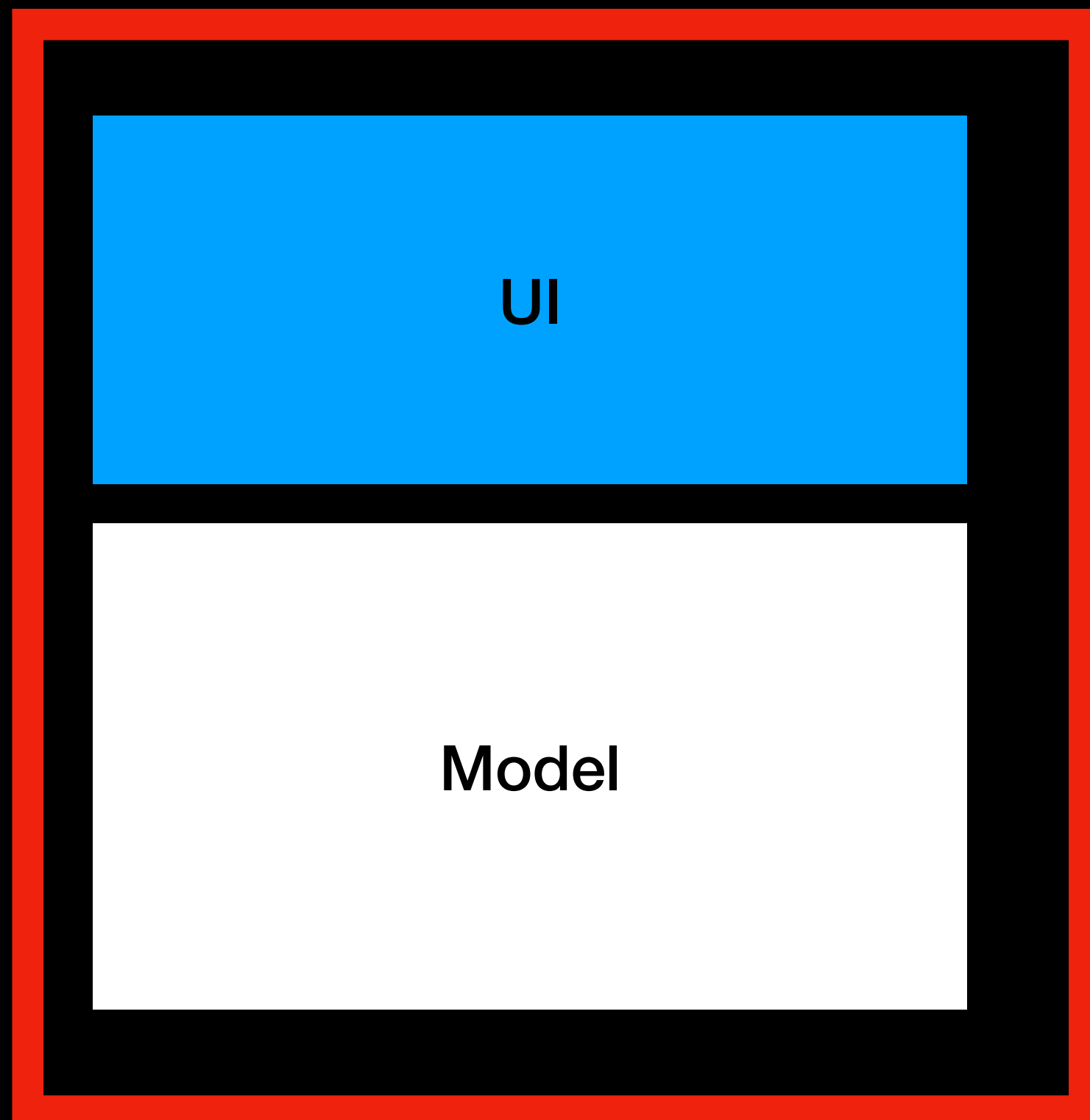
SwiftUI-Optimized



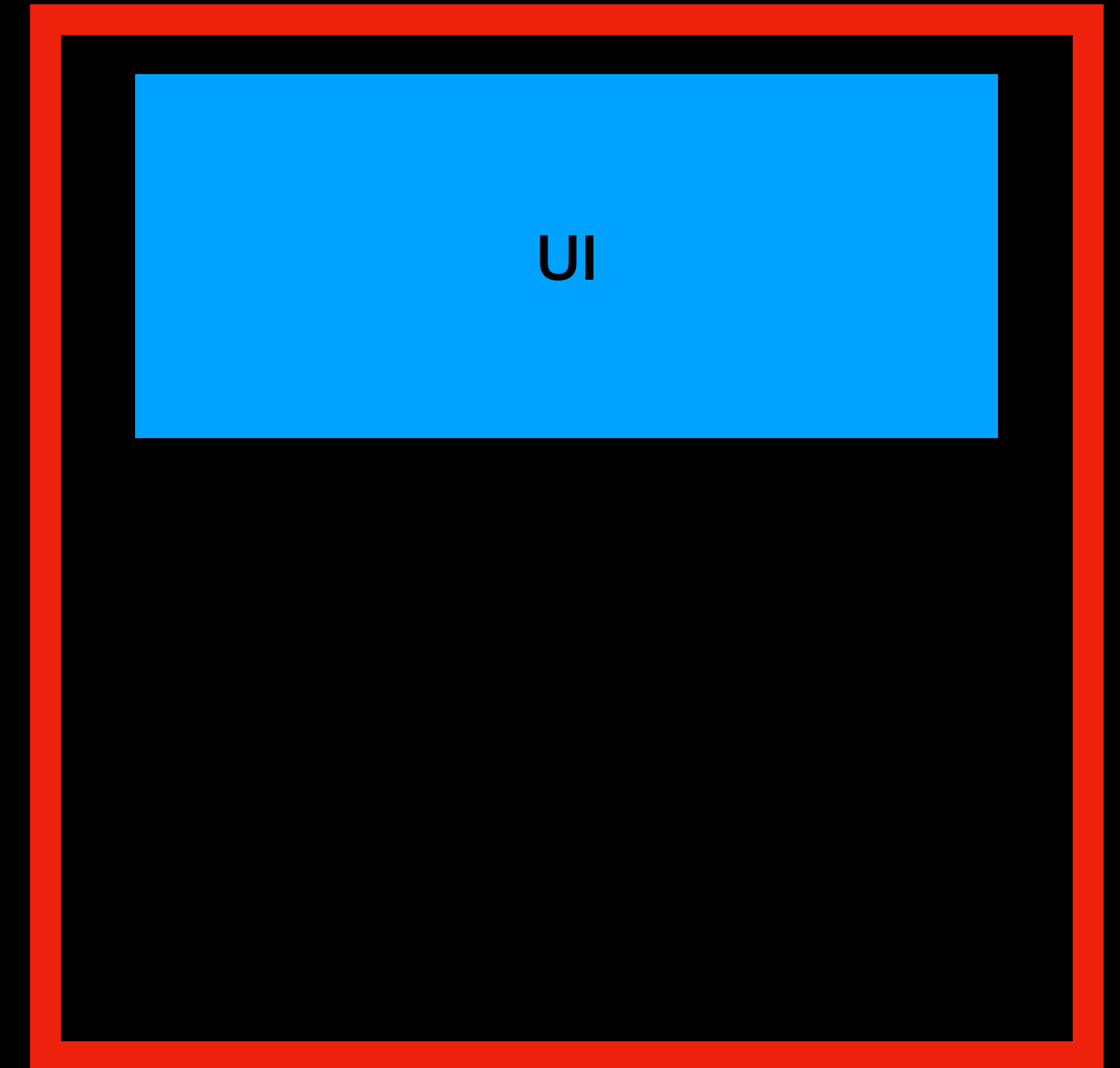
# Healthy Previews

## Separating UI from the Model

“Normal” app



SwiftUI-Optimized



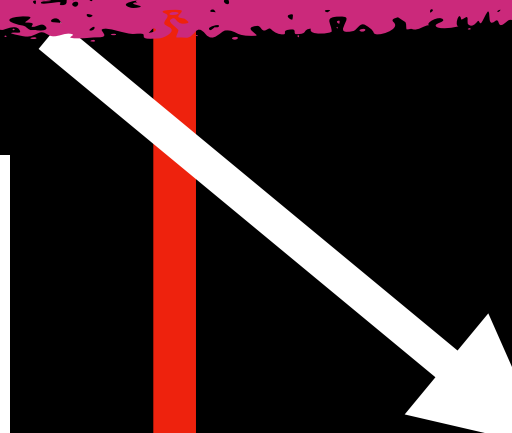
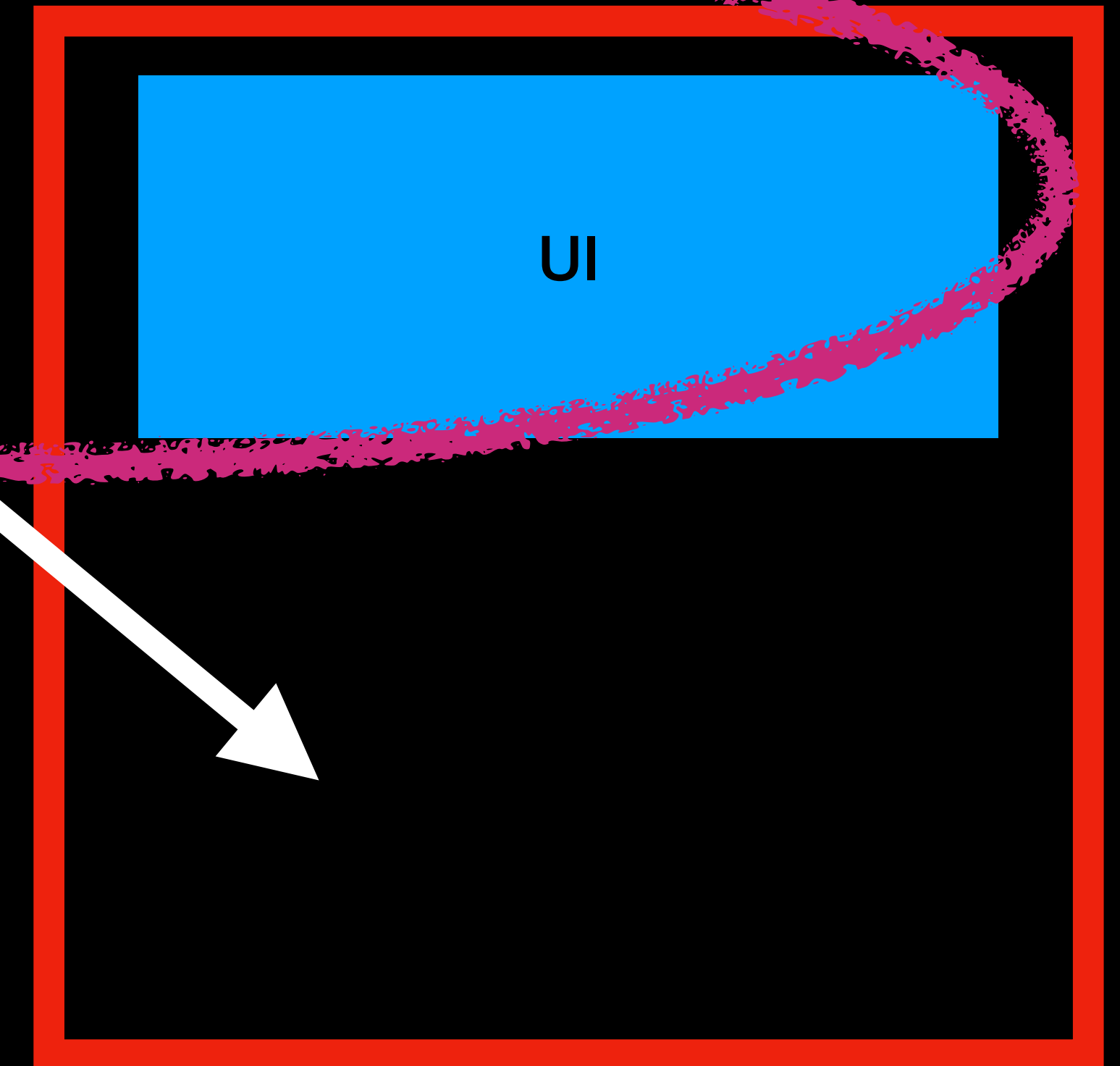
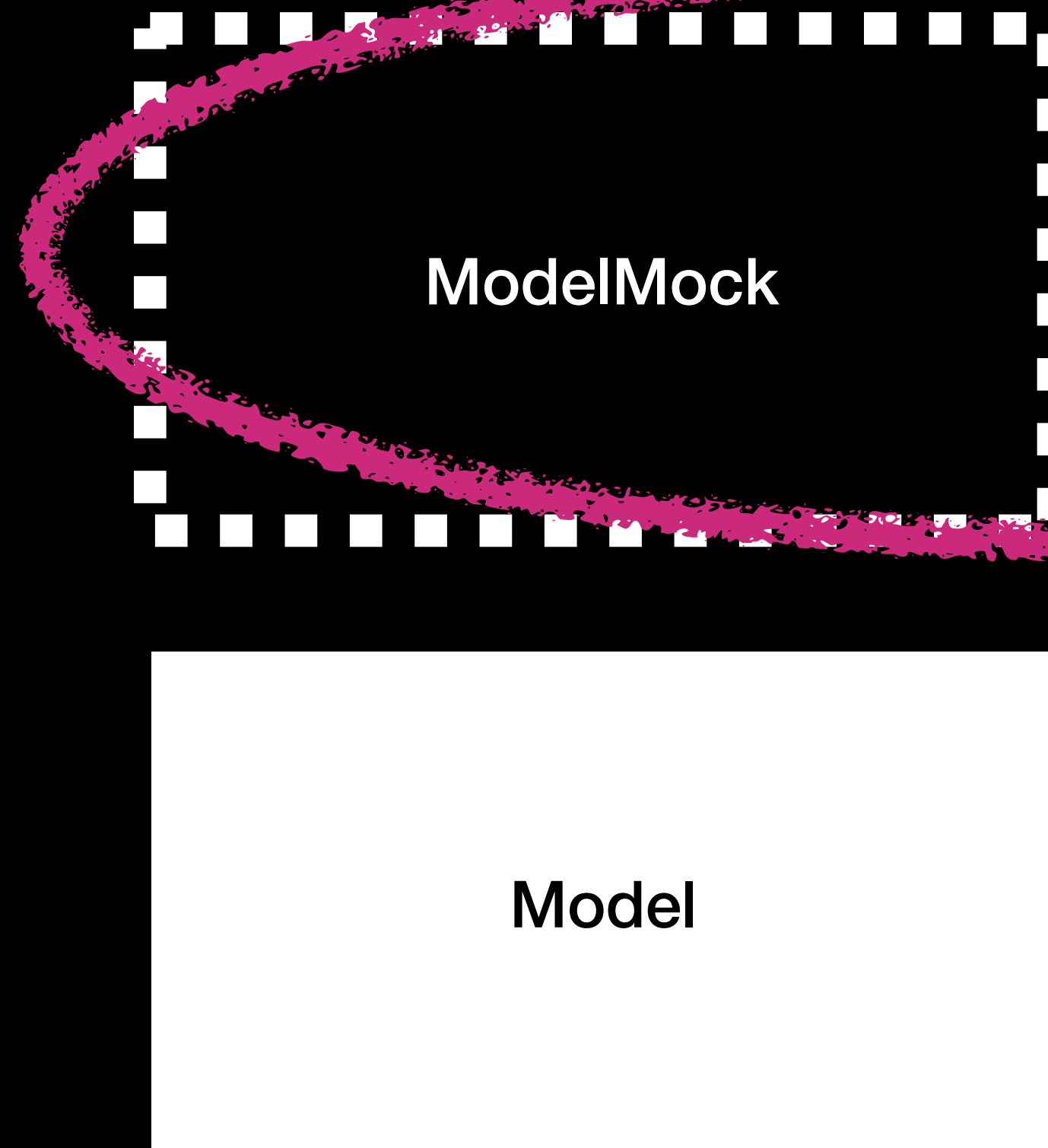
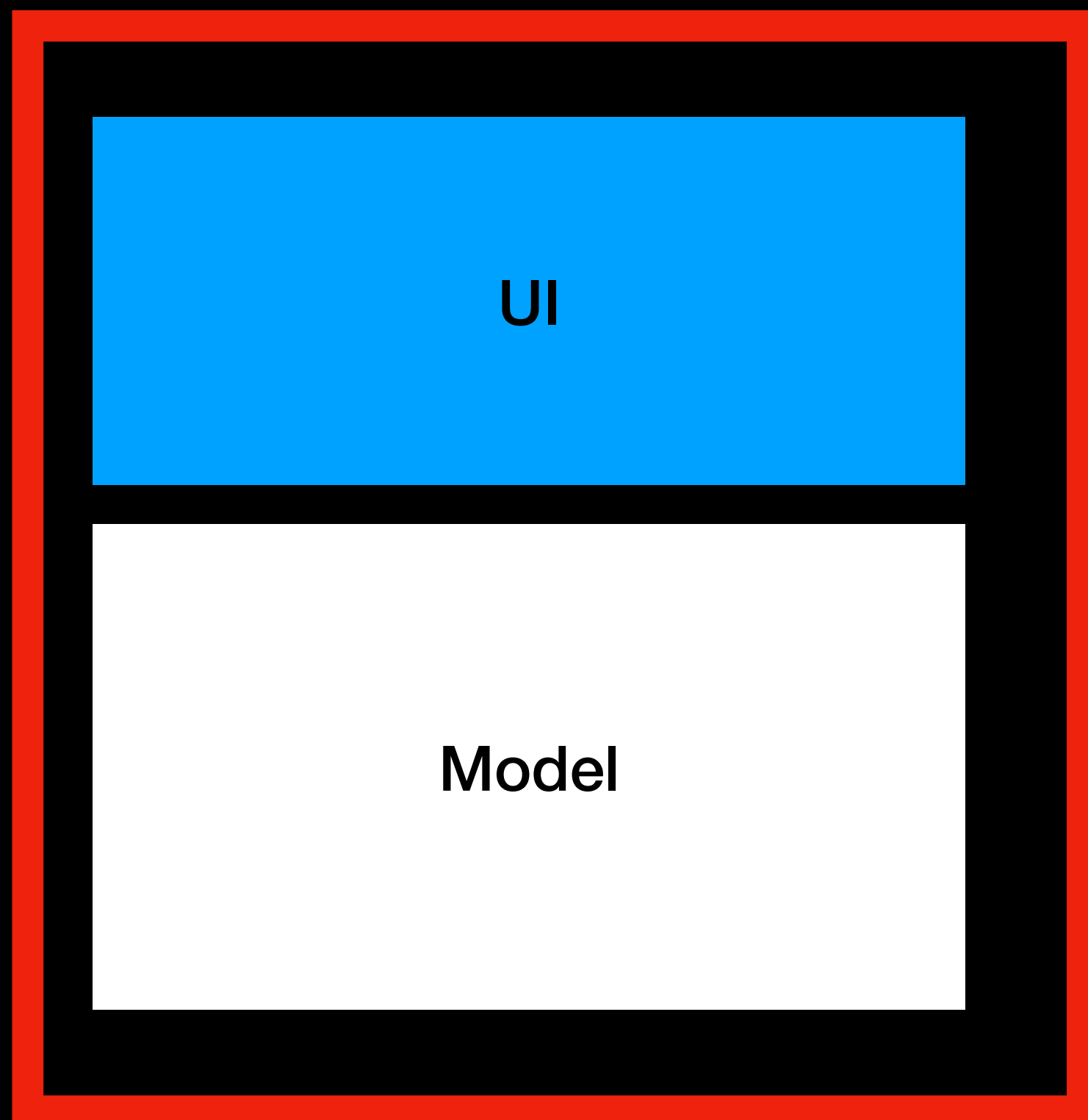
# Healthy Previews

## Separating UI from the Model

Preview Target

“Normal” app

SwiftUI Optimized



**Healthy Previews: Code**

# Healthy Previews: Code

# Healthy Previews: Code

```
import SwiftUI
```

```
protocol ModelProtocol {}
```

```
class ModelReal: ModelProtocol {}
```

```
class ModelMock: ModelProtocol {}
```



# Healthy Previews: Code

```
import SwiftUI
```

```
protocol ModelProtocol {}
```

```
class ModelReal: ModelProtocol {}
```

```
class ModelMock: ModelProtocol {}
```



Very Lightweight

# Healthy Previews: Code

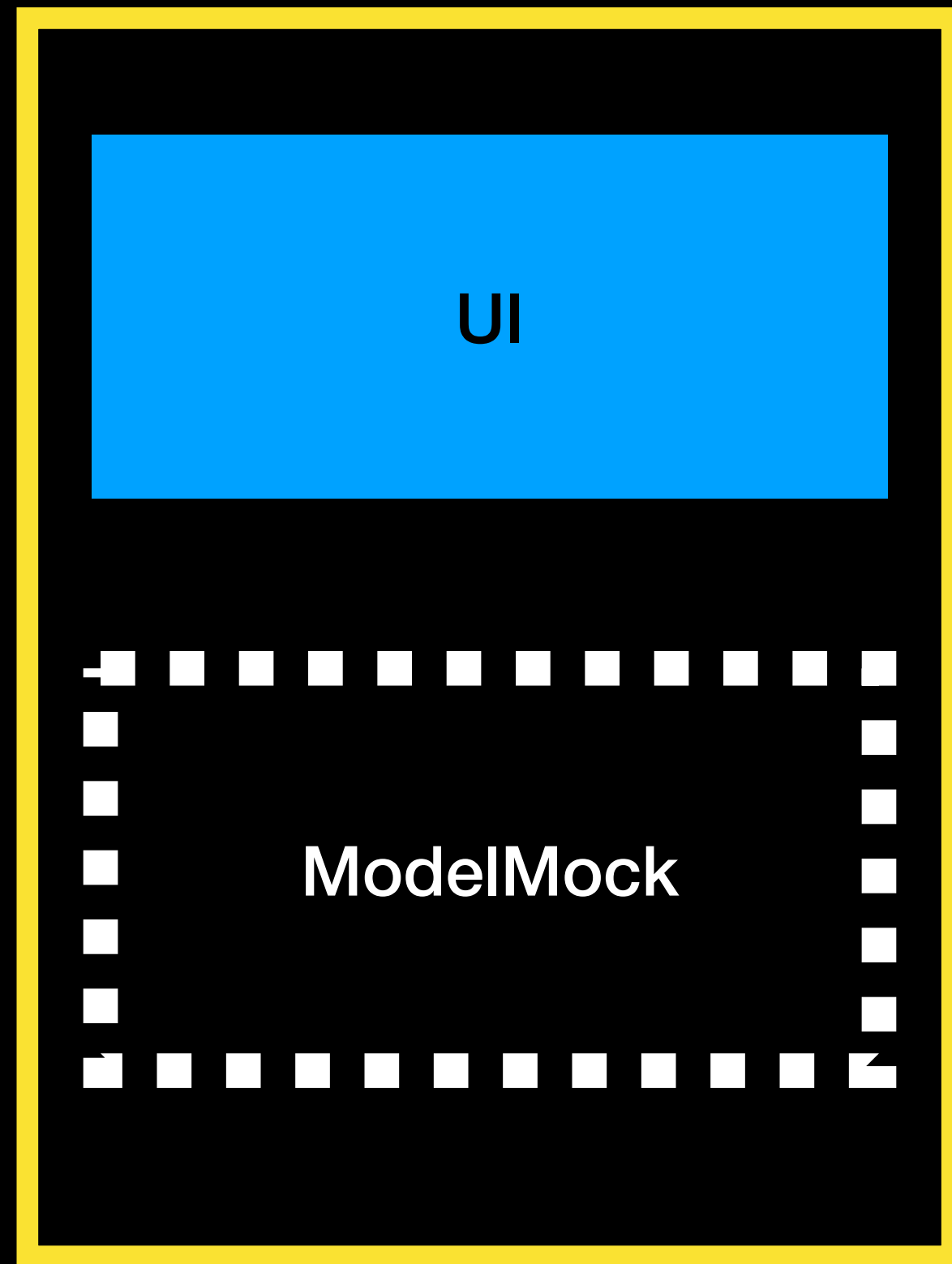
```
struct MyView: View {  
    let model: ModelProtocol  
  
    var body: some View {  
        Circle()  
    }  
}
```

# Healthy Previews: Code

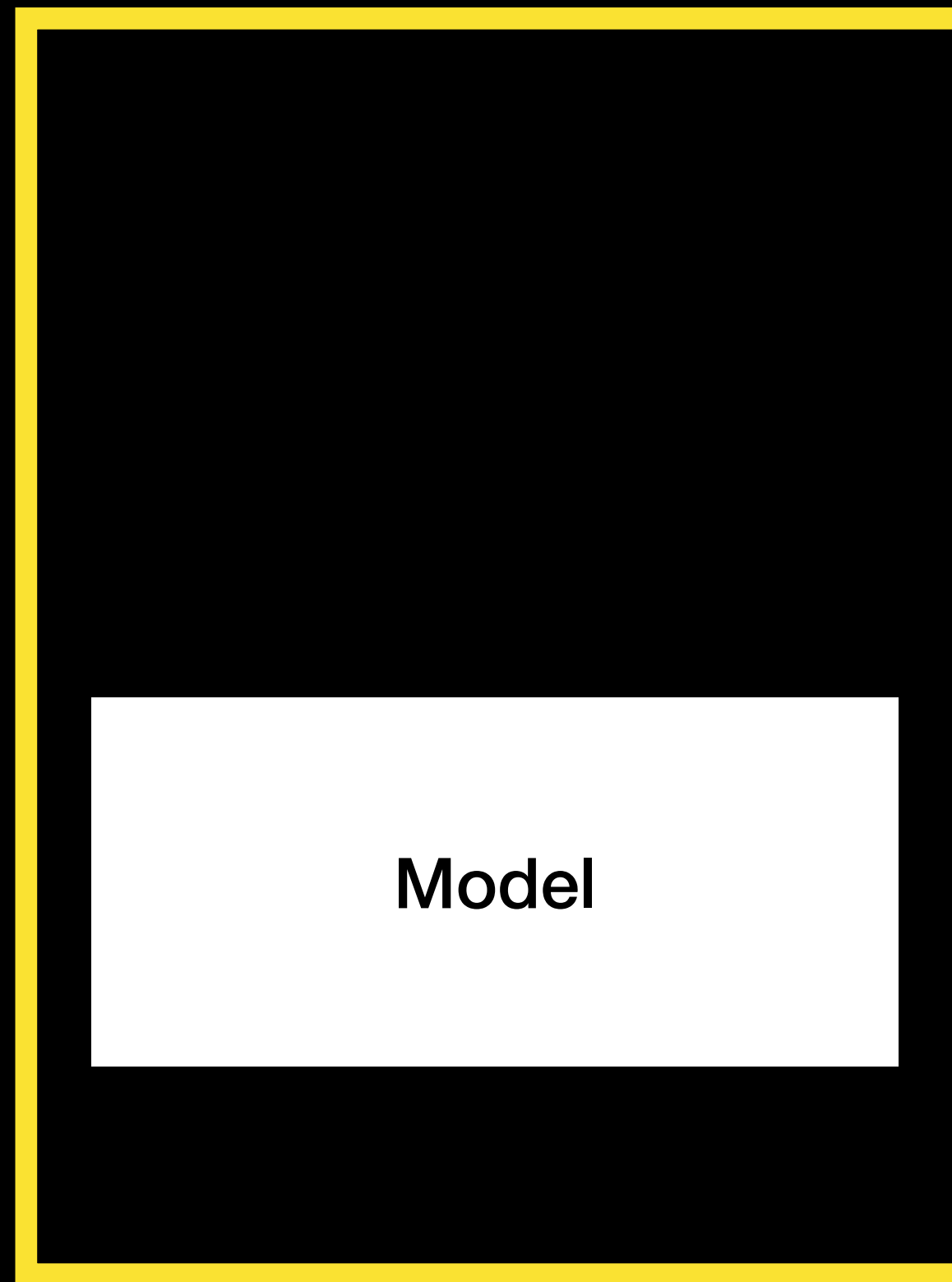
```
struct MyView_Previews: PreviewProvider {  
    static let modelMock: ModelProtocol =  
ModelMock()  
    static var previews: some View {  
        MyView(model: modelMock)  
    }  
}
```

**Use Swift Package Manager**

# Use Swift Package Manager



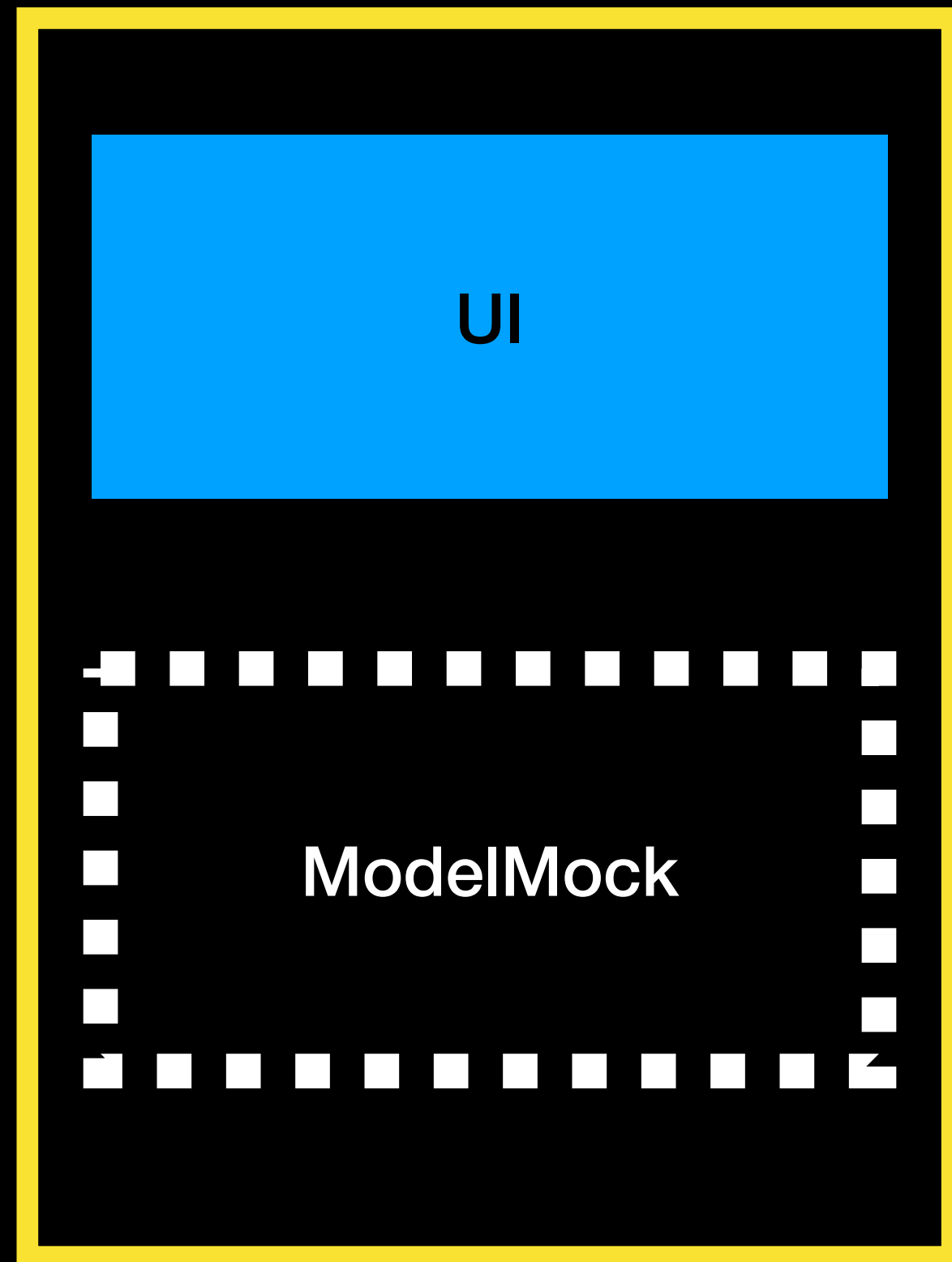
Package 1



Package 2

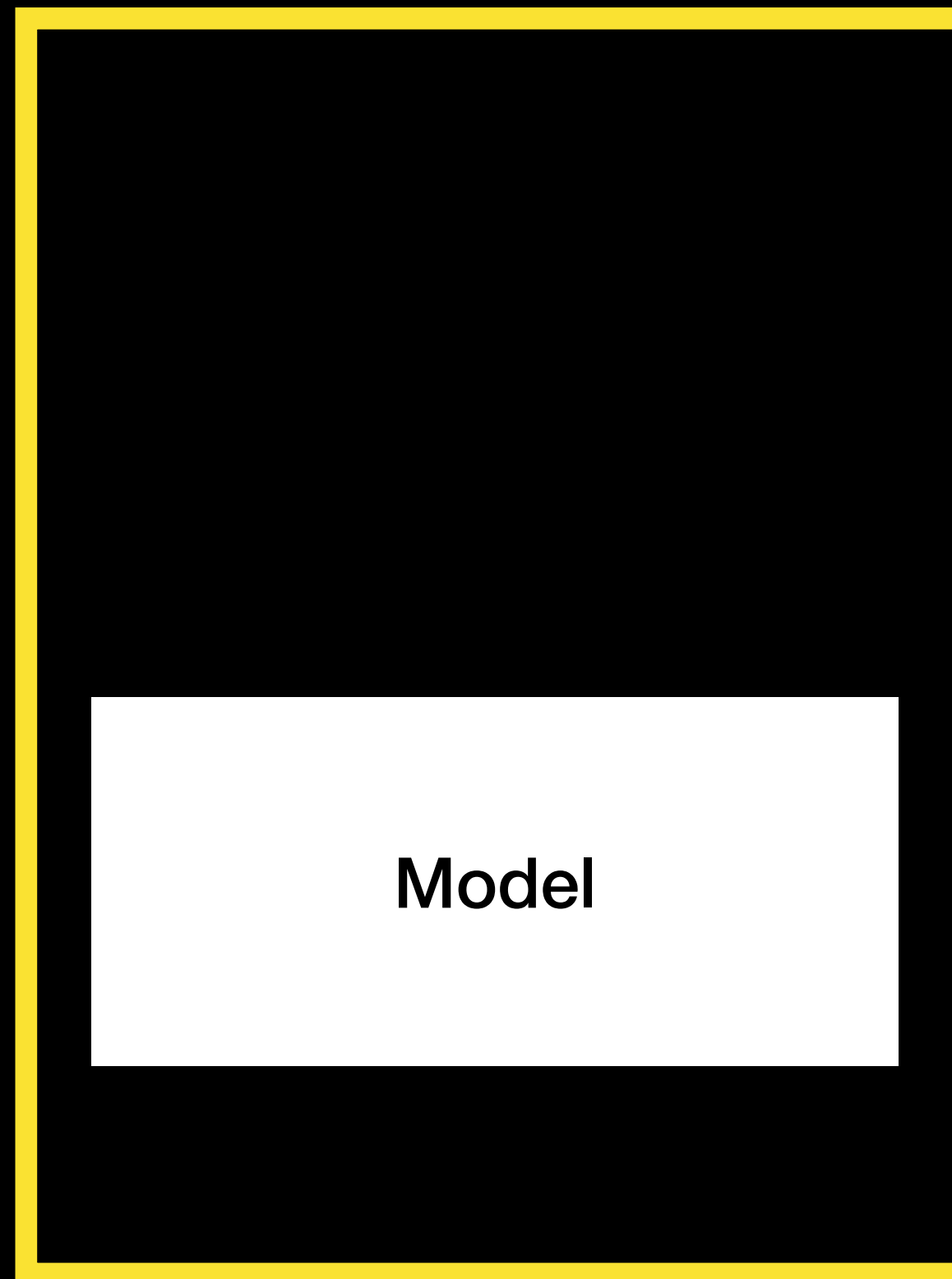
# Use Swift Package Manager

**iOS**

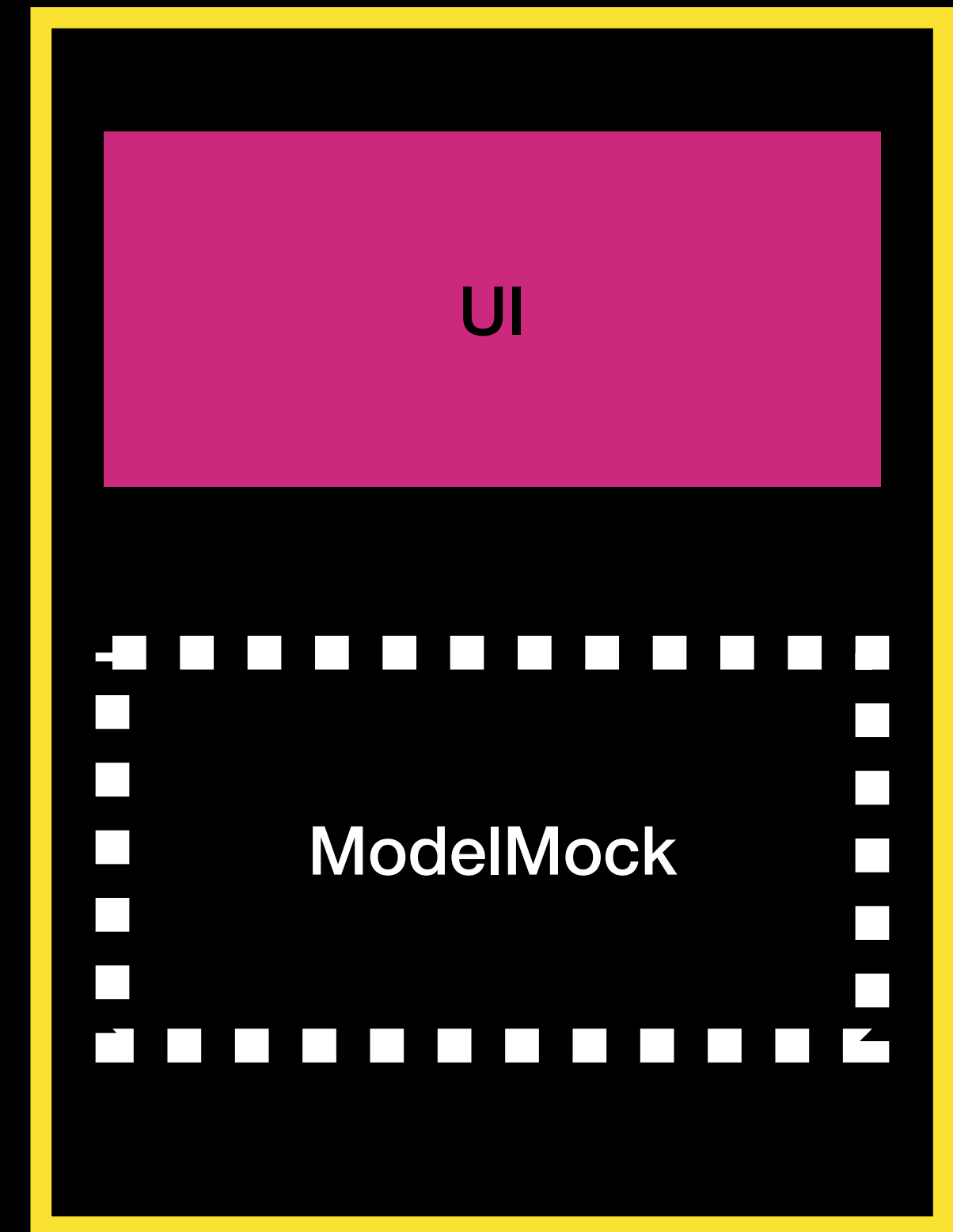


**Package 1**

**Mac**



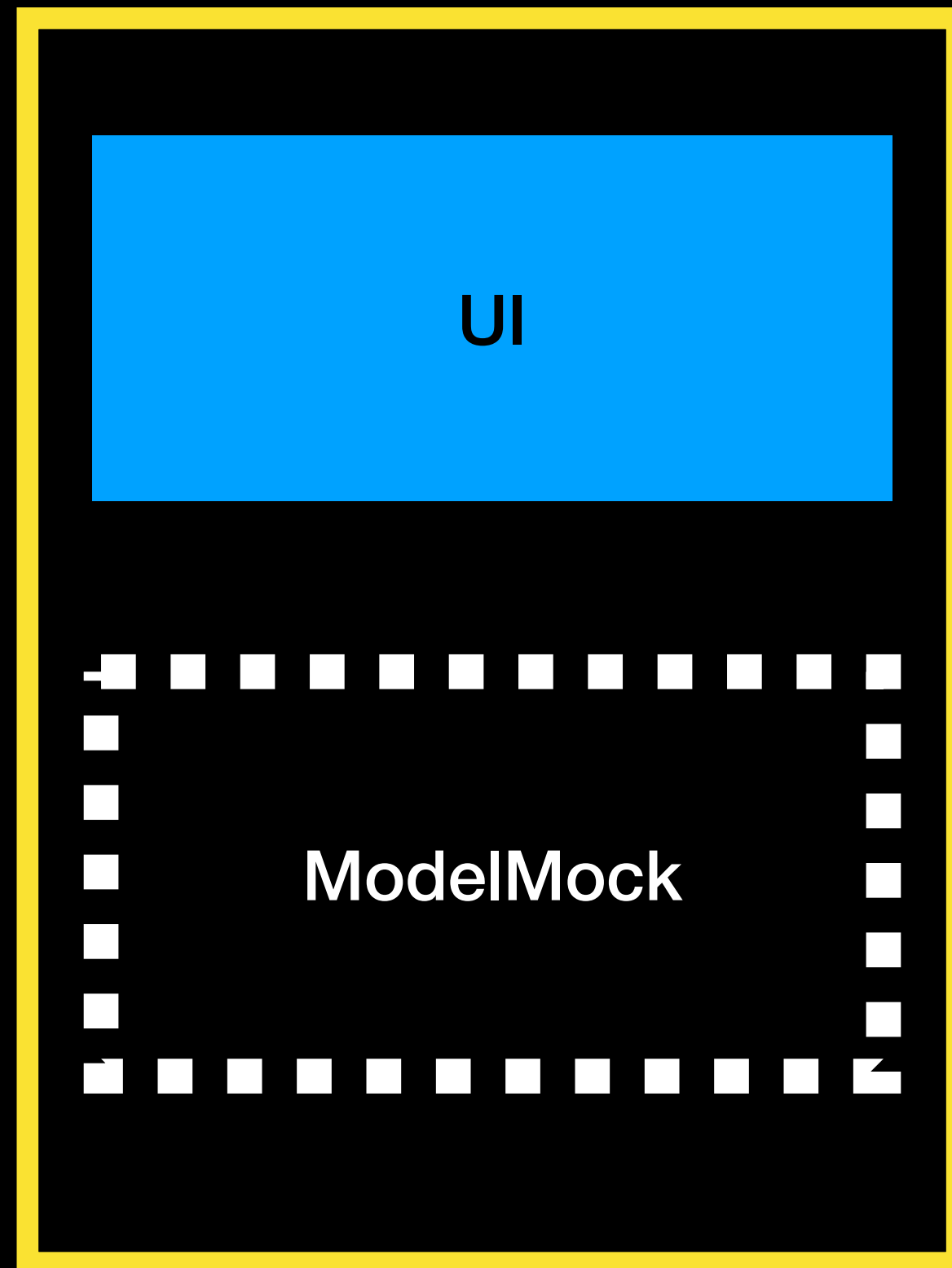
**Package 2**



**Package 3**

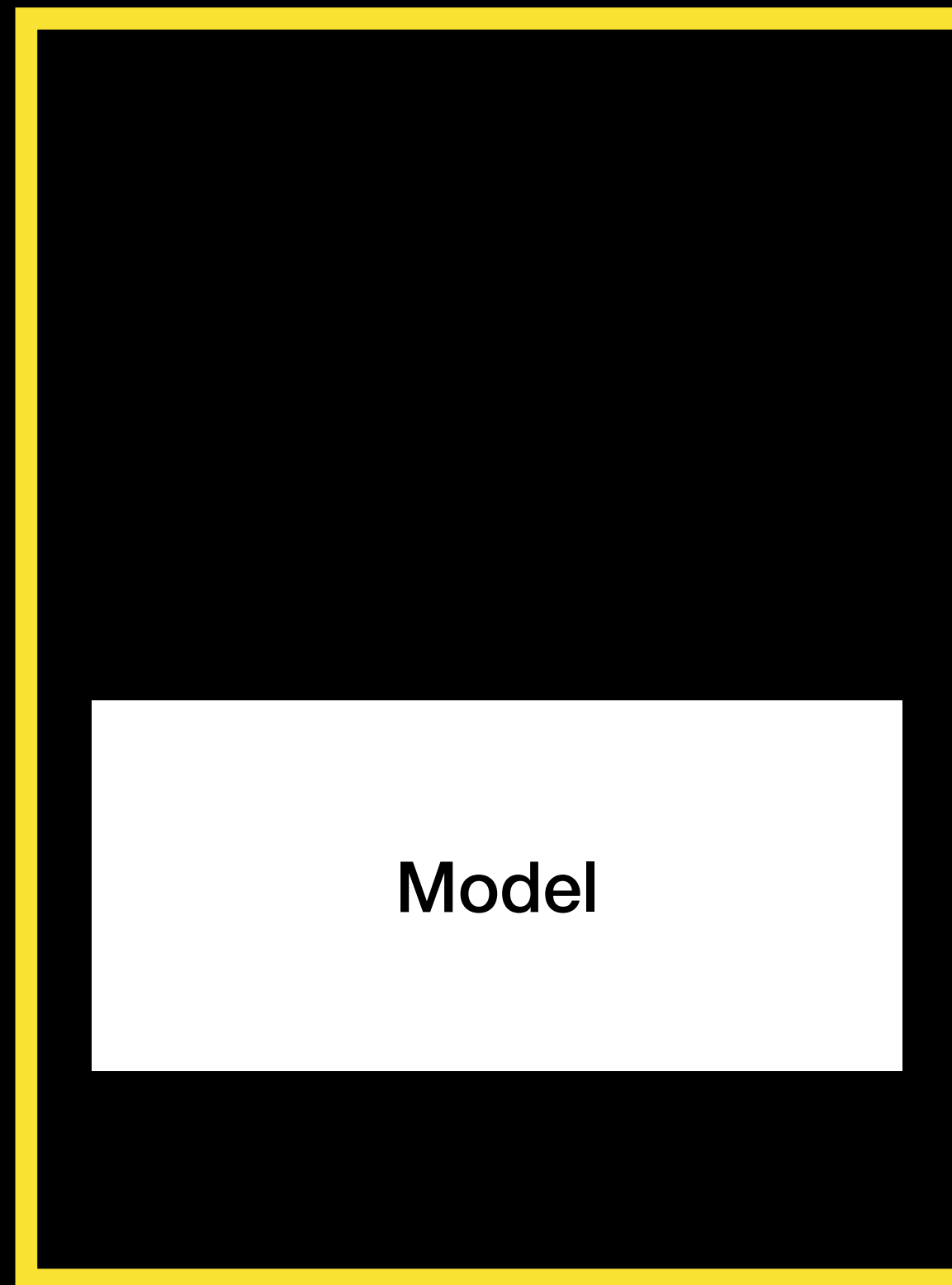
# Use Swift Package Manager

**iOS**

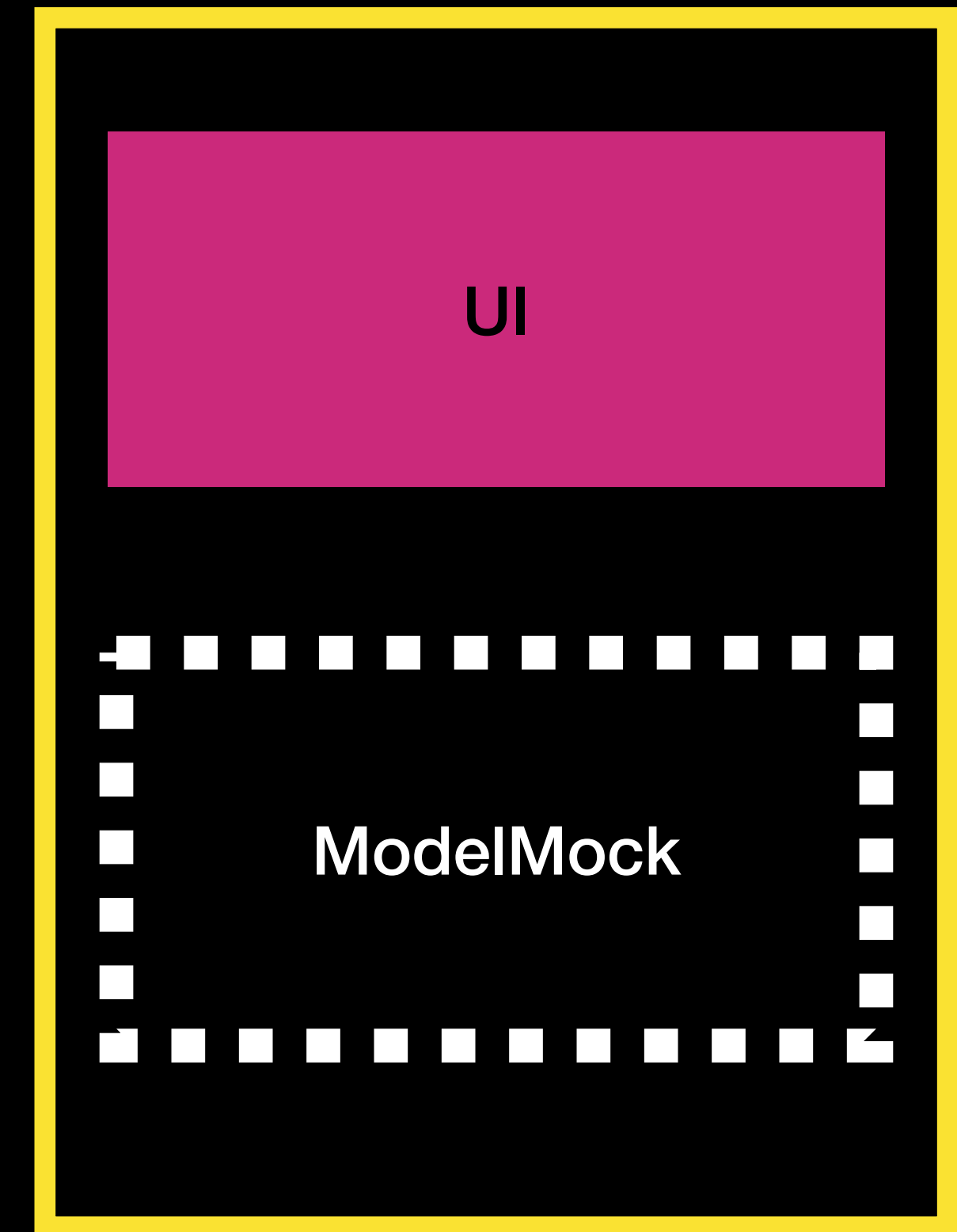


**Team iOS**

**Mac**



**Both Teams**



**Team Mac**

# Localizations



# Localizations

```
Text("Localized Text")
```

# Localizations



**Bundle: main**

```
Text("Localized Text")
```

# Localizations

```
Text("Localized Text")
```

```
Text("Localized Text", bundle: .module)
```

# Localizations

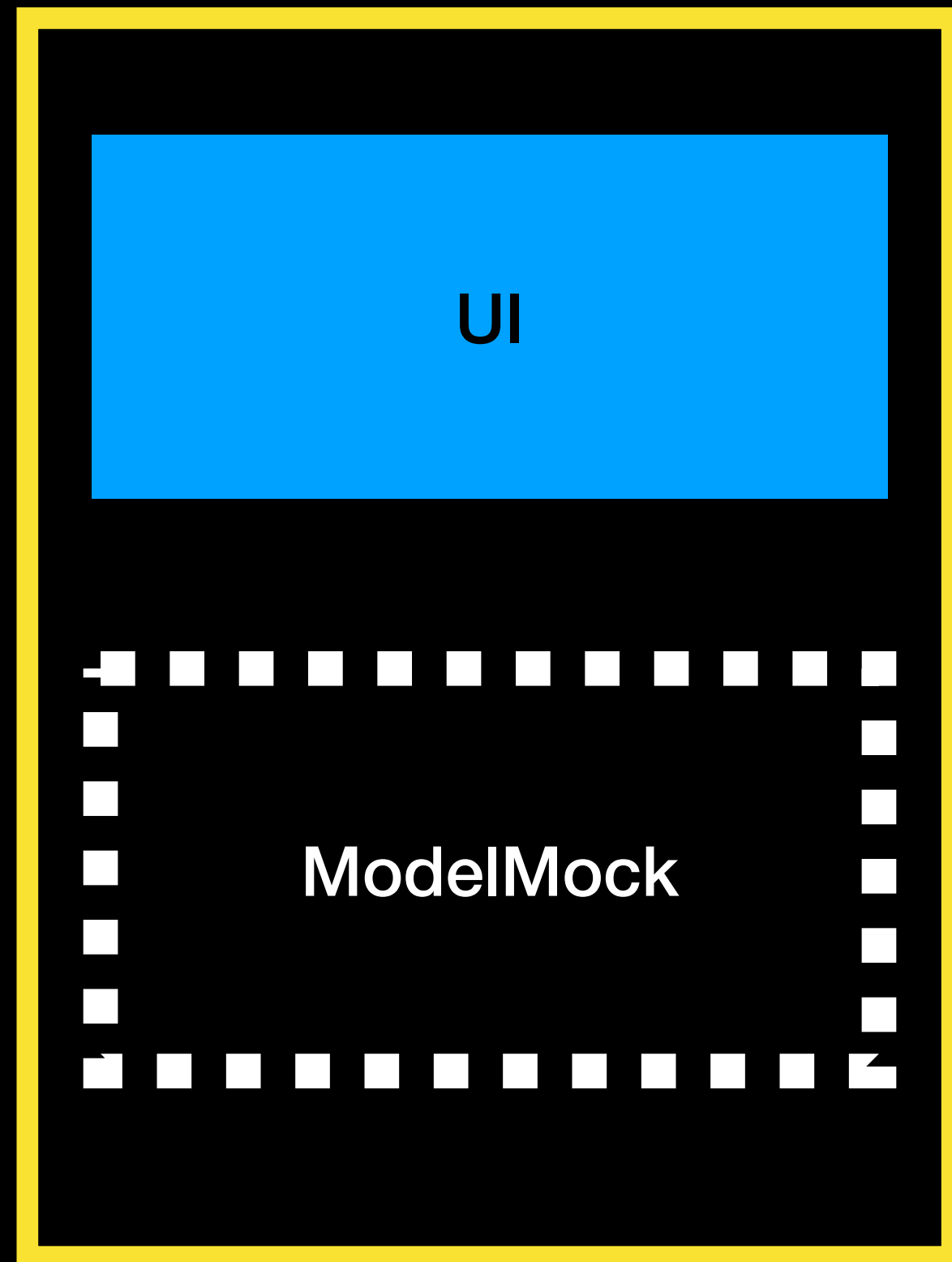
```
Text("Localized Text")
```

```
Text("Localized Text", bundle: .module)
```

Shared UI

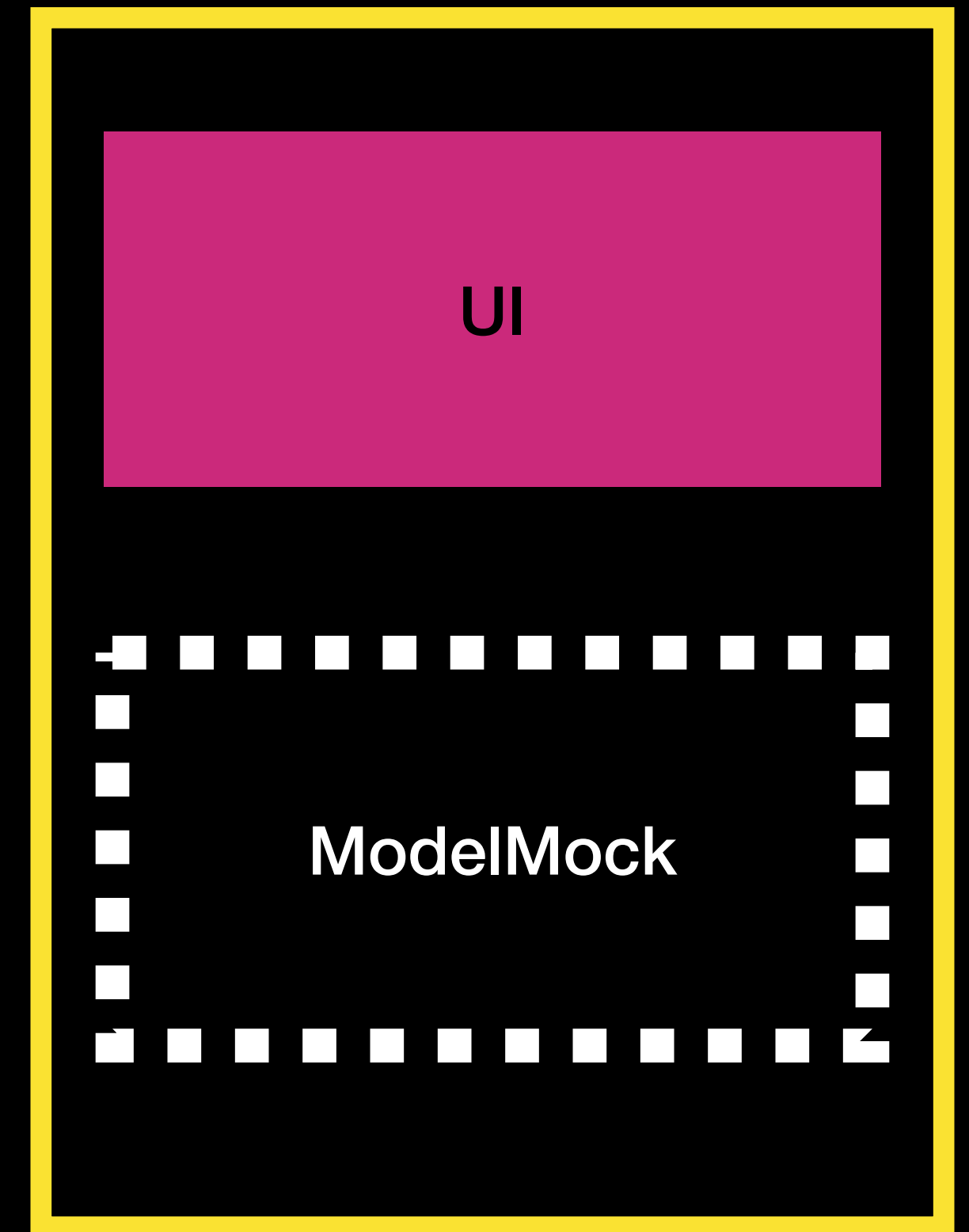
# Shared UI

## iOS



Team iOS

## Mac



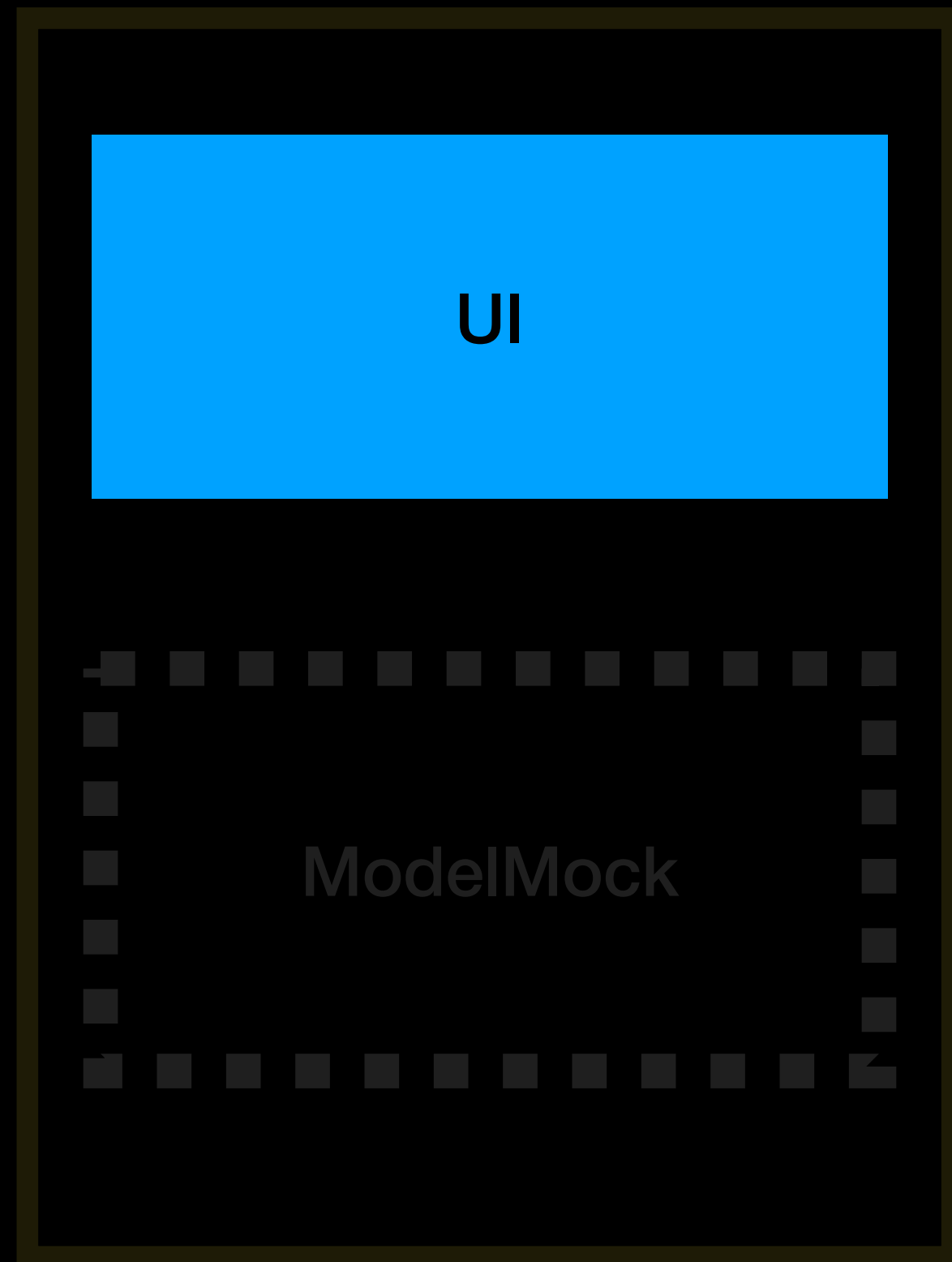
Team Mac

Model

Both Teams

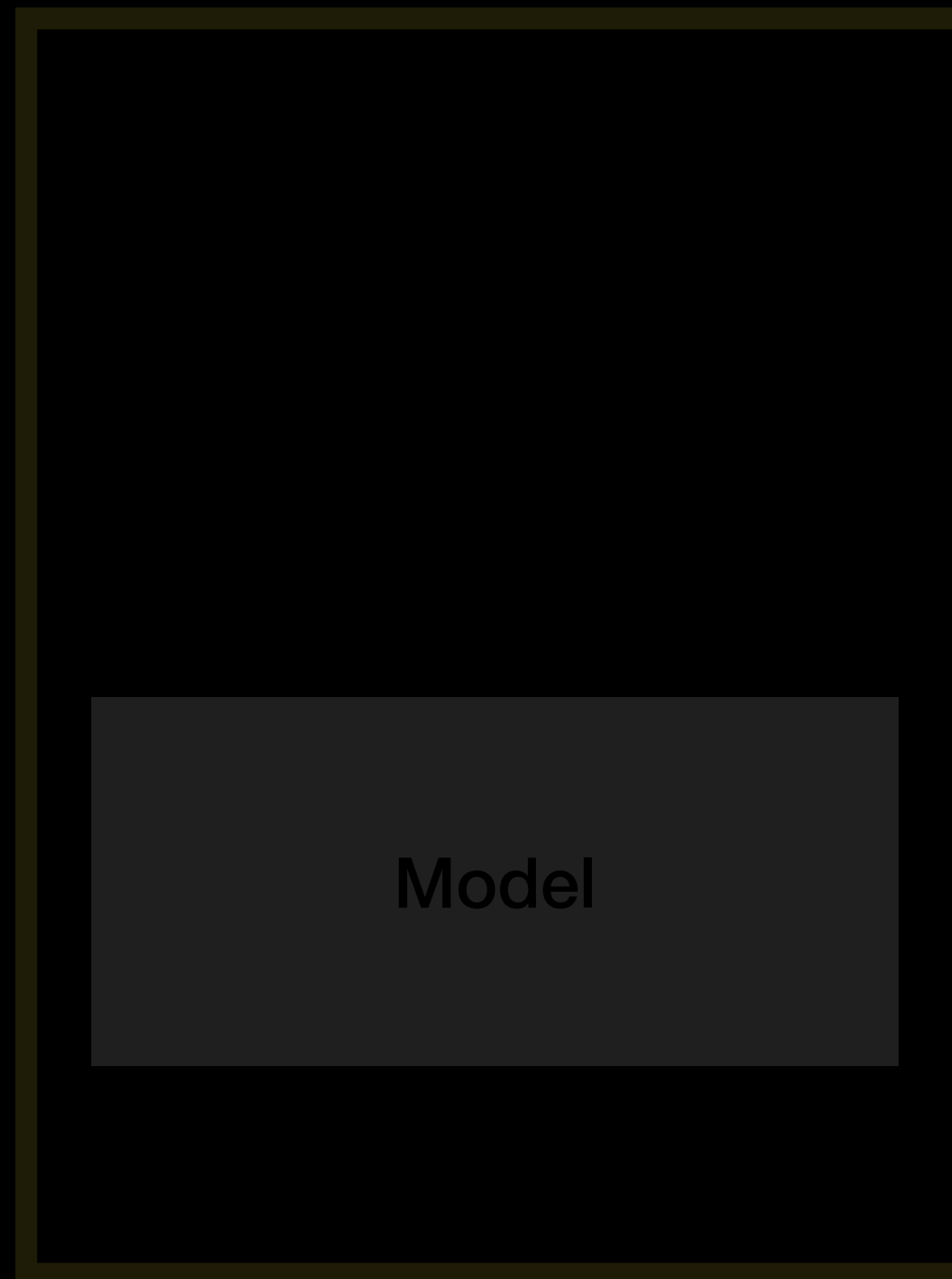
# Shared UI

## iOS

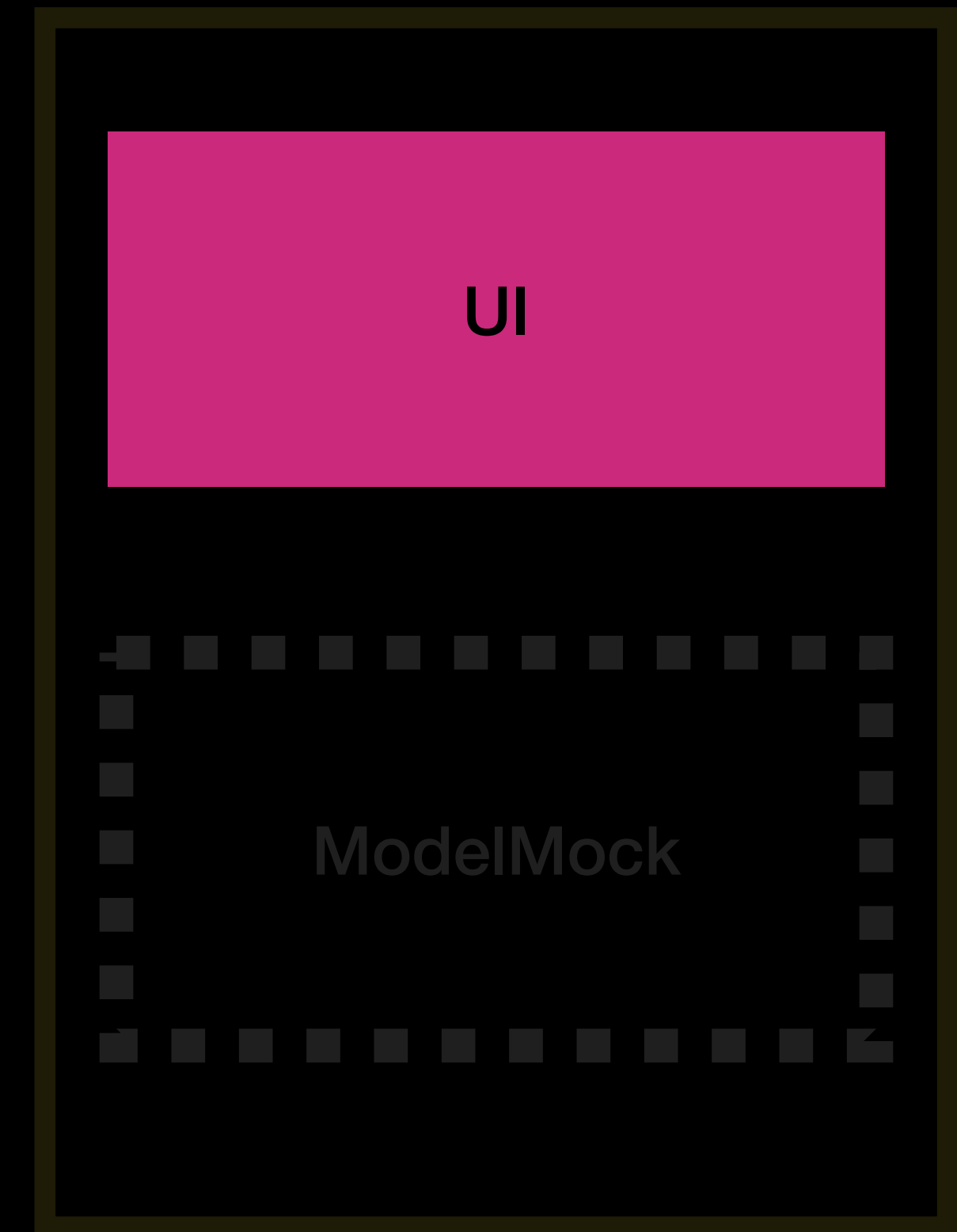


Team iOS

## Mac



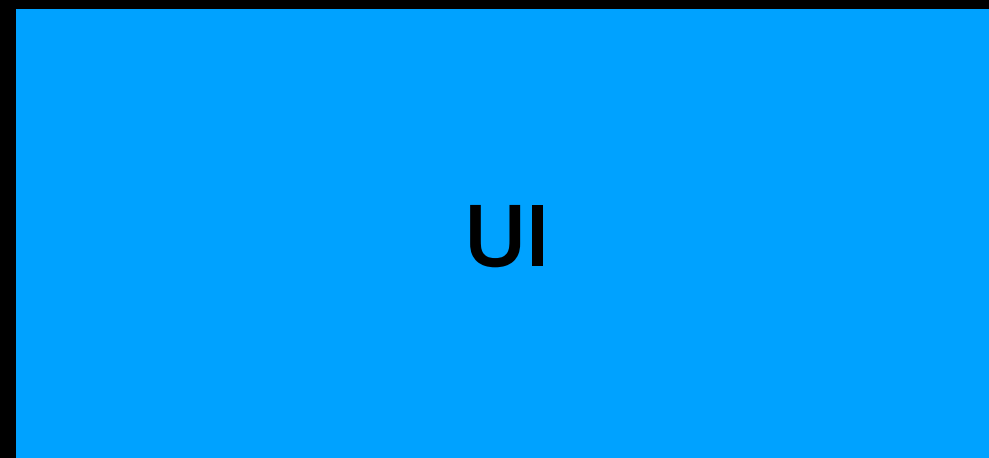
Both Teams



Team Mac

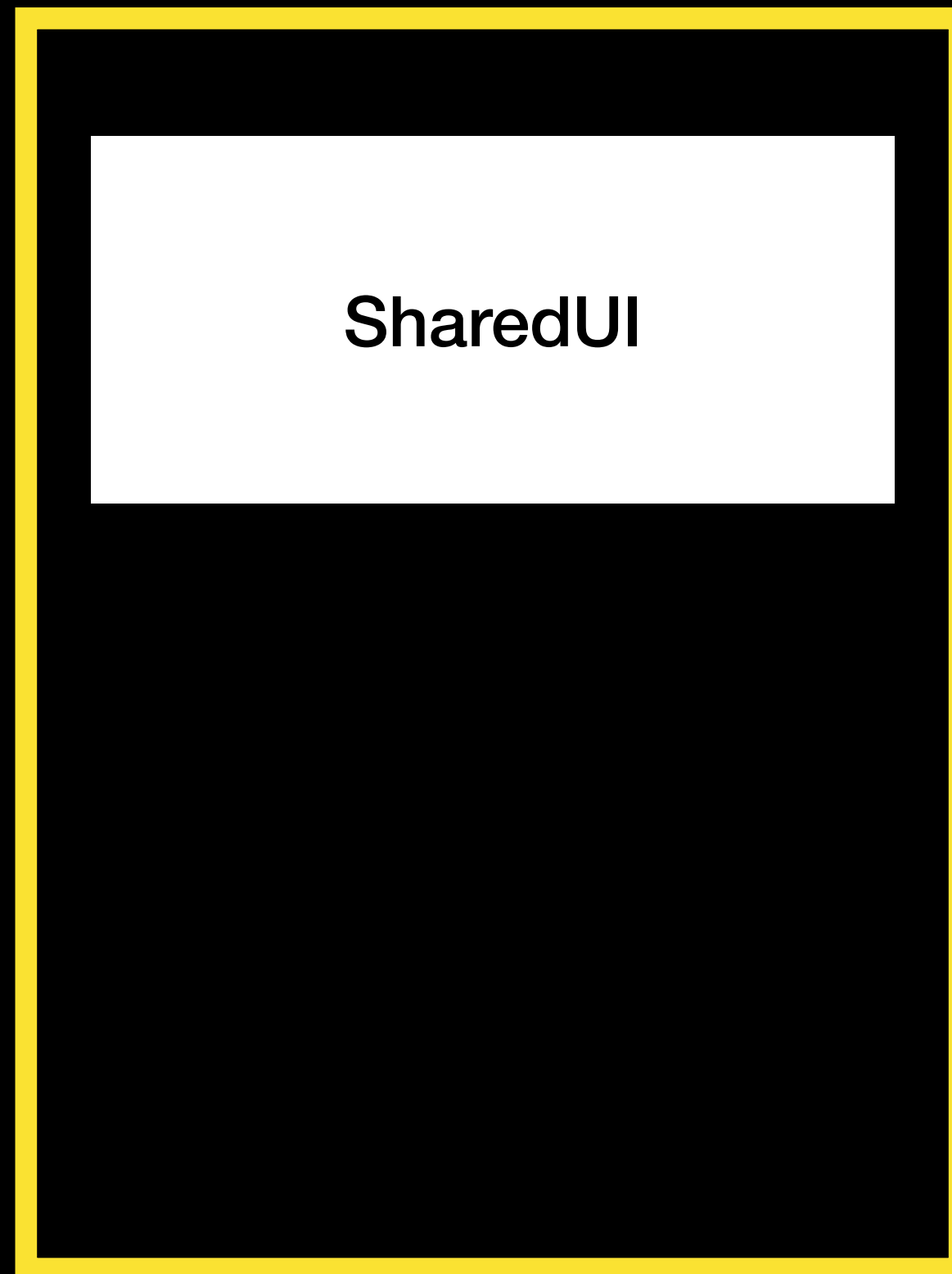
# Shared UI

iOS



Team iOS

# Shared Library



Both Teams

Mac

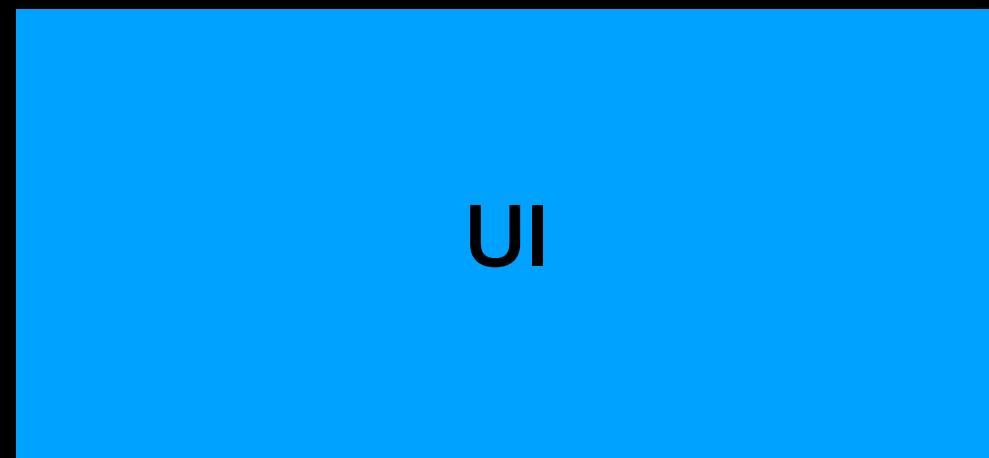


Team Mac



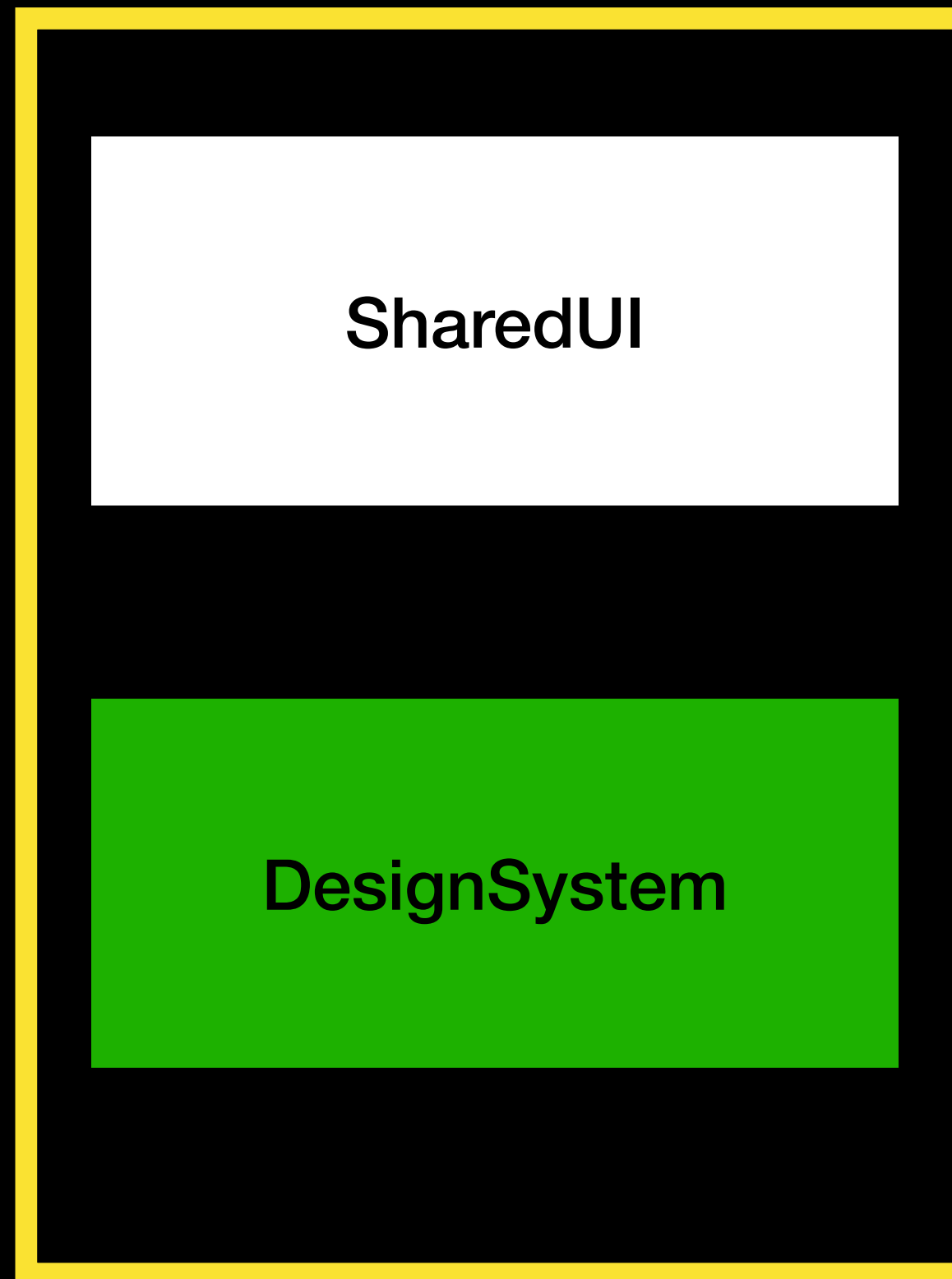
# Shared UI

iOS



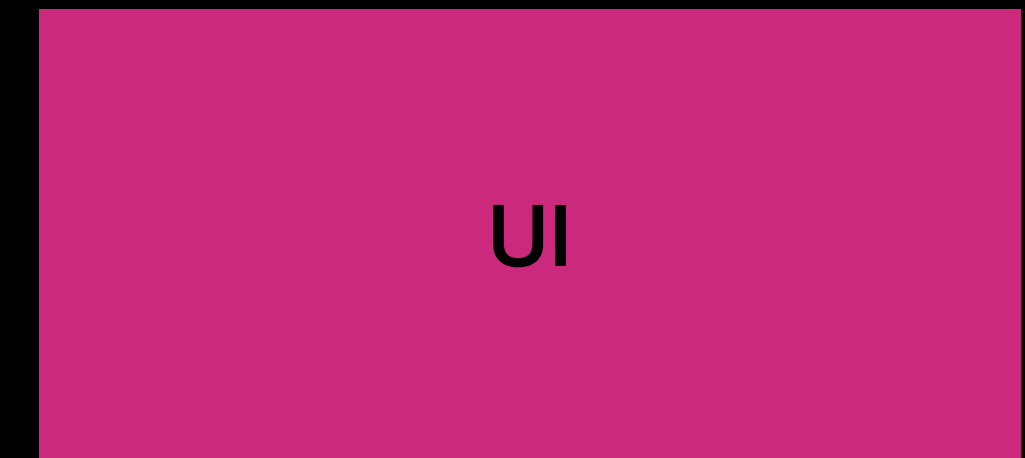
Team iOS

# Shared Library



Both Teams

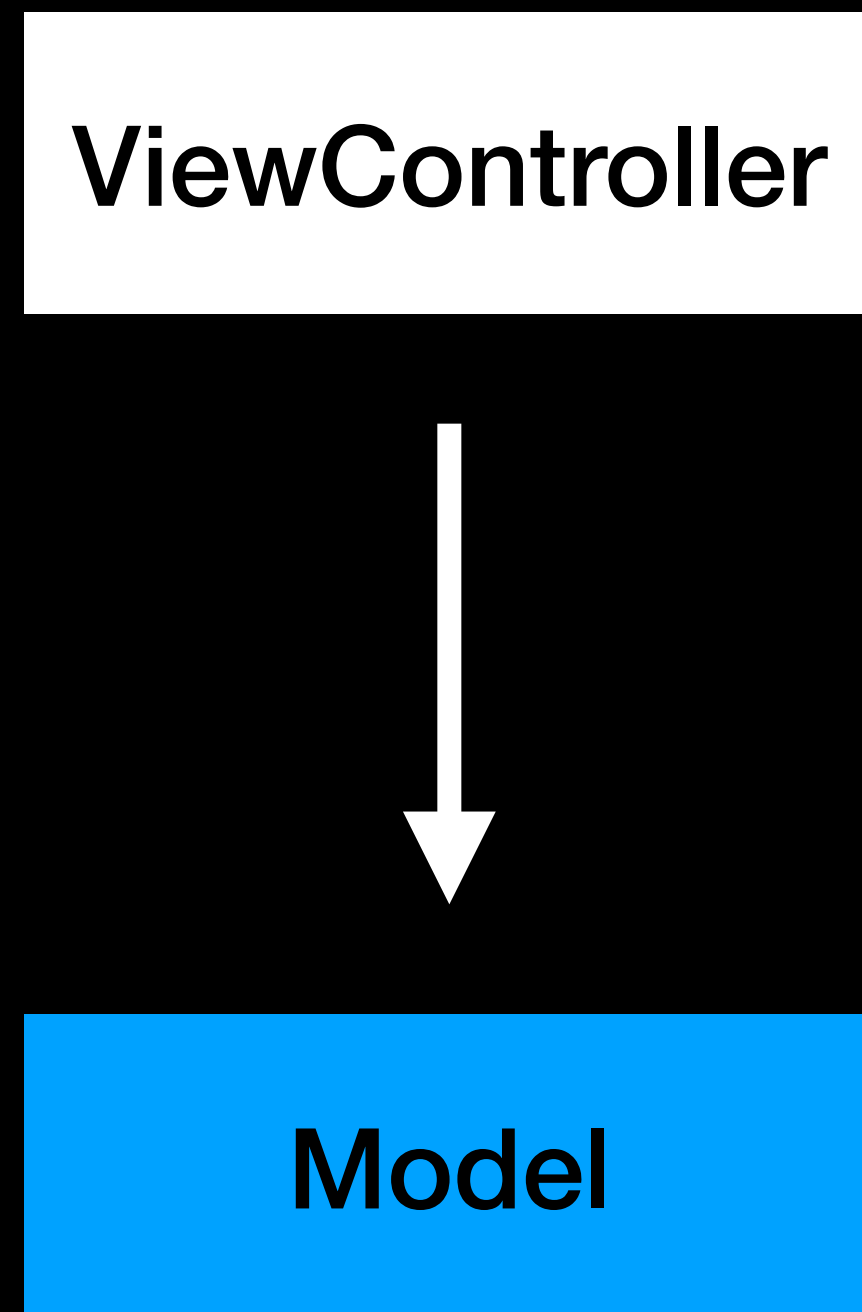
Mac



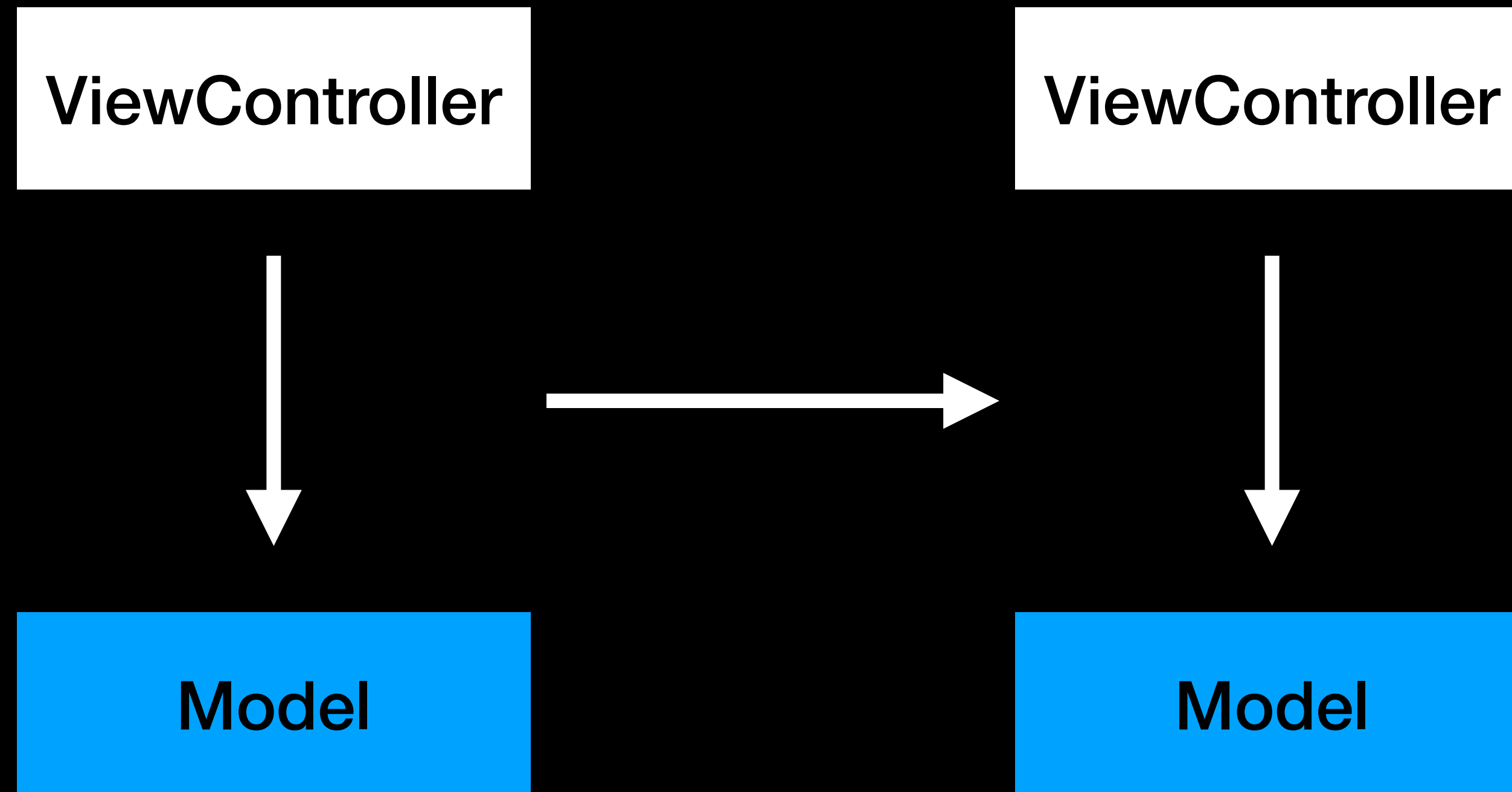
Team Mac

# Memory Management

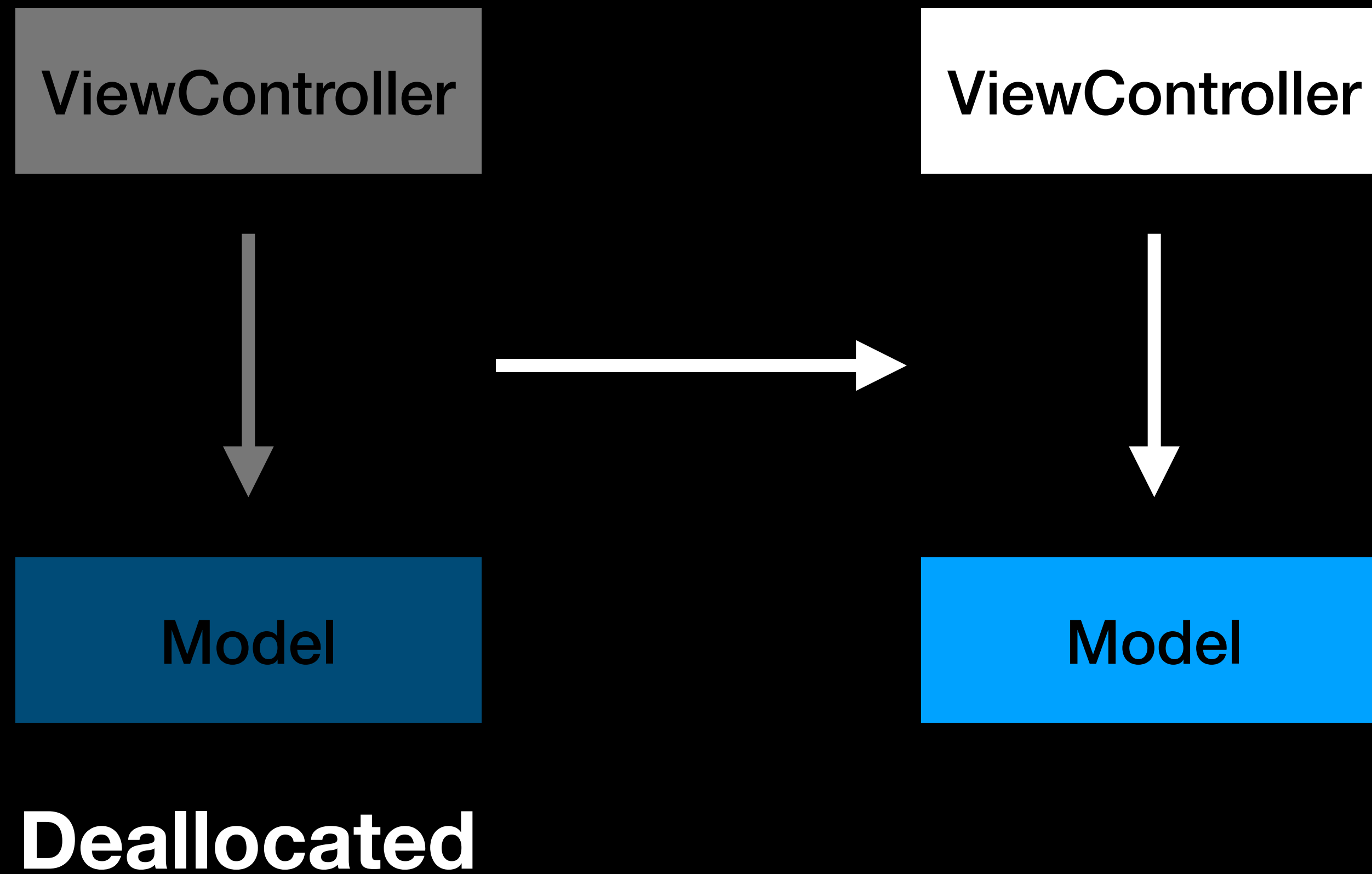
# Memory Management: UIKit



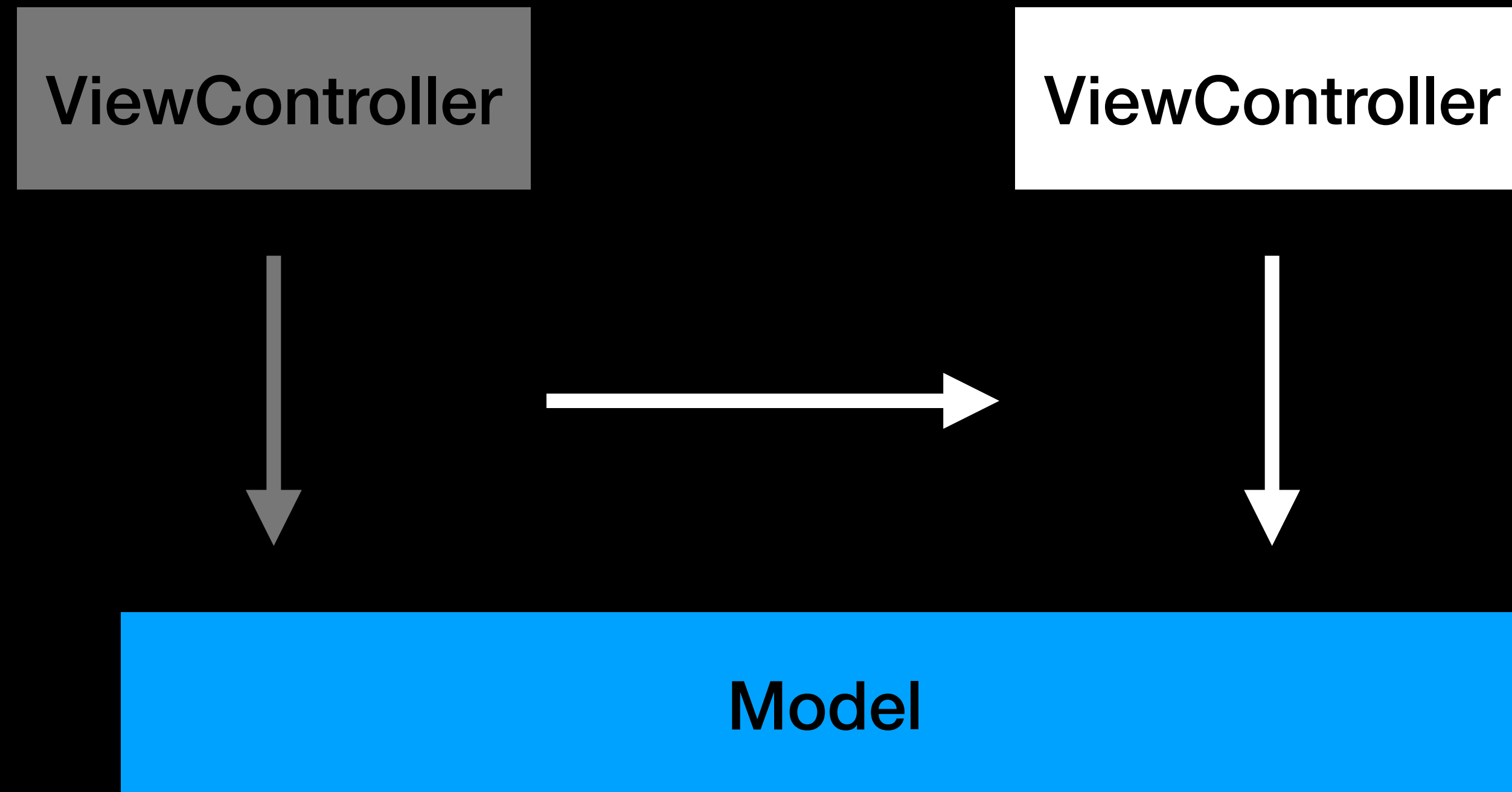
# Memory Management: UIKit



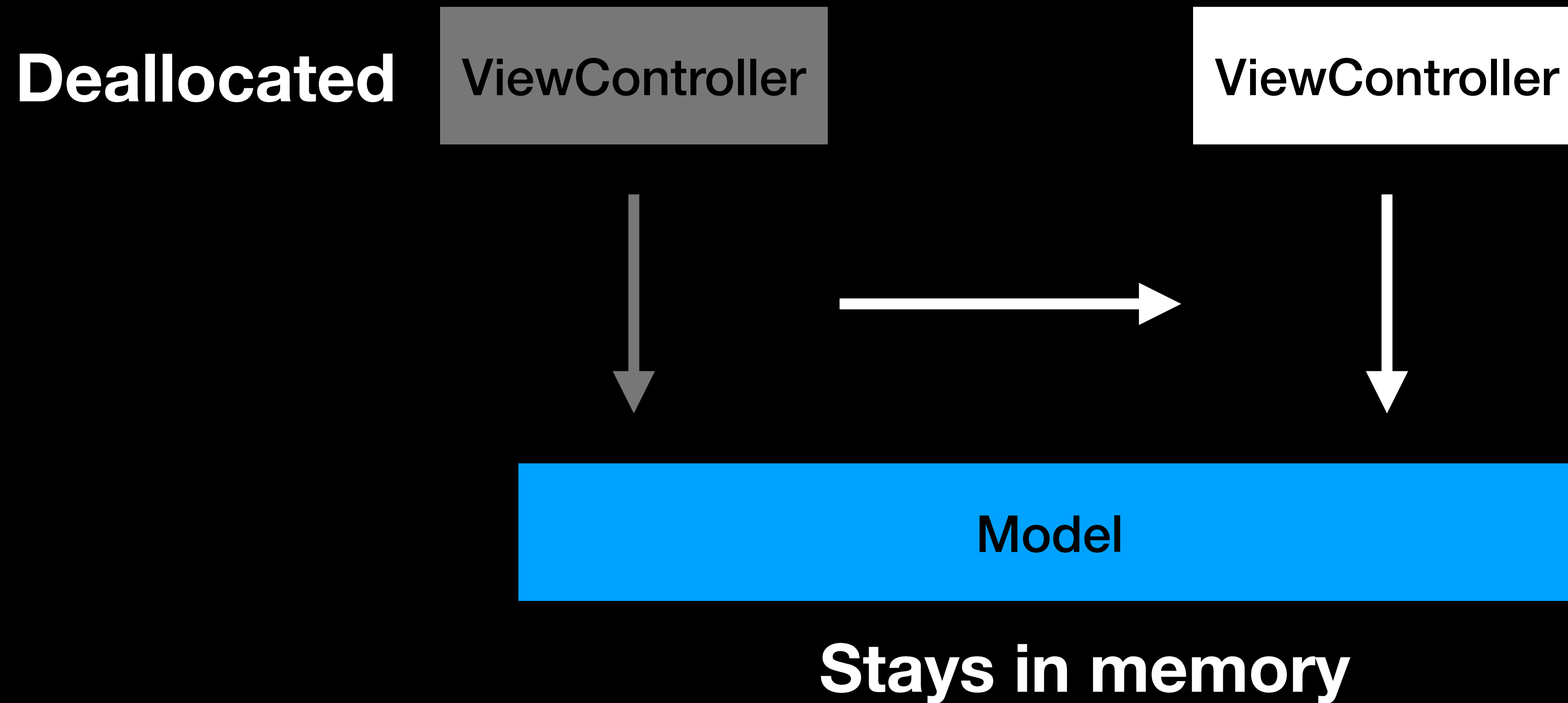
# Memory Management: UIKit



# Memory Management: UIKit, case 2



# Memory Management: UIKit, case 2



# Memory Management: SwiftUI



# Memory Management: SwiftUI

```
final class ViewModel: ObservableObject {  
    @Published var title = "Title"  
    @Published var subtitle = "Title"  
}
```

**SwiftUI View is a struct**

# Memory Management: SwiftUI

**@StateObject**

**@State**

# Memory Management: SwiftUI

**@StateObject**

**@State**

**@ObservedObject**

# Memory Management: SwiftUI

**@StateObject**

**@State**

**@ObservedObject**

**View Creates and owns  
Is kept across view regeneration**

**View Just Observes**

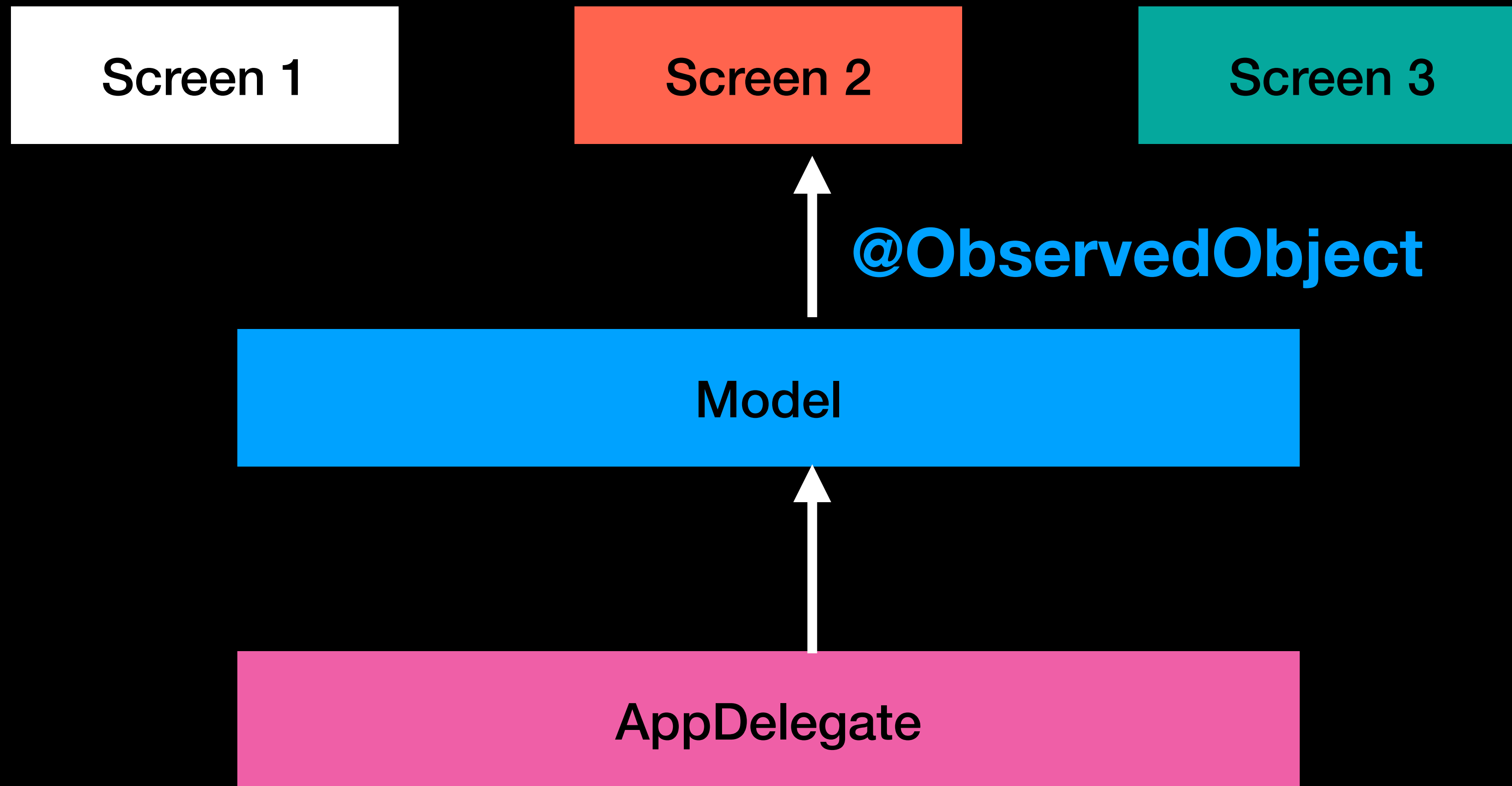
# Memory Management: SwiftUI

```
final class ViewModel: ObservableObject {  
    @Published var title = "Title"  
    @Published var subtitle = "Title"  
}
```

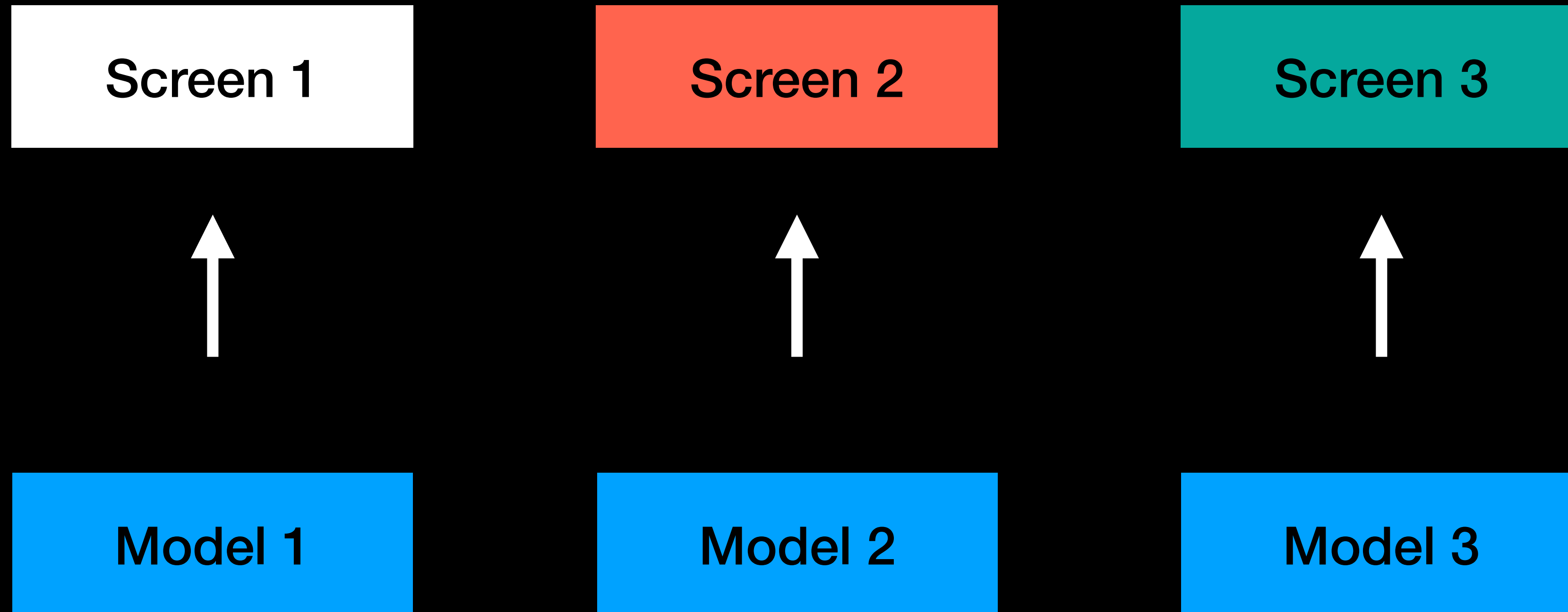
```
@ObservedObject private var viewModel: ViewModelType
```

```
init(viewModel: ViewModelType,  
    self.viewModel = viewModel) {  
}
```

# Memory Management: SwiftUI

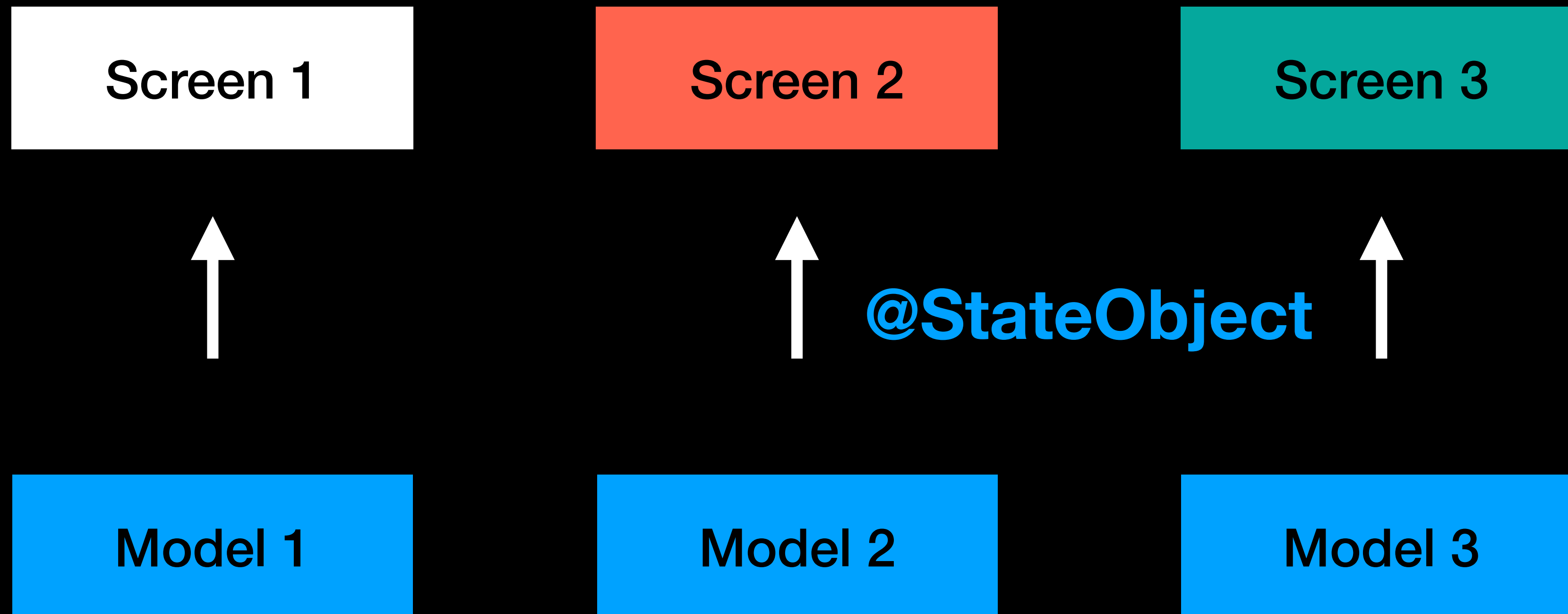


# Memory Management: SwiftUI





# Memory Management: SwiftUI



# Memory Management: SwiftUI

```
@StateObject private var viewModel: ViewModel  
  
init(viewModel: ViewModel,  
    self._viewModel = StateObject(wrappedValue: viewModel)  
}
```

# Memory Management: SwiftUI

```
@StateObject private var viewModel: ViewModel  
init(viewModel: ViewModel,  
    self.viewModel = StateObject(wrappedValue: viewModel)  
}
```



**STOP**

# Memory Management: SwiftUI

```
@StateObject private var viewModel: ViewModel  
init(viewModel: ViewModel,  
    self.viewModel = StateObject(wrappedValue: viewModel)  
}
```

**View Model is created multiple times**

# Memory Management: SwiftUI

```
@StateObject private var viewModel: ViewModel

init(viewModel: @autoclosure @escaping () -> ViewModel,
      self._viewModel = StateObject(wrappedValue: viewModel()))
}
```

# Memory Management: SwiftUI

```
@StateObject private var viewModel: ViewModel  
  
init(viewModel: @autoclosure @escaping () -> ViewModel,  
        self._viewModel = StateObject(wrappedValue: viewModel()))  
}
```



MyView(viewModel: MyViewModel())

# Memory Management: SwiftUI

## 1. Capturing the closure



```
@StateObject private var viewModel: ViewModel  
  
init(viewModel: @autoclosure @escaping () -> ViewModel,  
        self._viewModel = StateObject(wrappedValue: viewModel()))  
}
```

## 3. Assigning



## 2. Executing



**Q&A**



# FS Protection

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