IS 543 Fall 2023

Mobile Platform Development

Xcode Tour

Architecture: MVC and MVVM

Swift Fundamentals

Dr. Stephen W. Liddle
782 TNRB, office hours Tu 9:30-10:30am, Th 2-3pm
is543@byu.edu
801-422-8792 (rings on my cell)
Zoom: https://bit.ly/liddlezoom

Today

- Tour of Xcode 15
- Architecture: MVC and MVVM
- More SwiftUI demo

HW 1 Debrief

- How was HW 1 for you?
  Any particular observations you want to share?
  Any lingering questions we should answer?
  Any trouble getting a free developer account or getting Xcode 15 installed?
- Do you have any questions from reading the syllabus?
- Any questions from viewing the Map It demo video?

Time to Kahoot!

- 10-question group quiz, for fun and learning, not for actual points

Map It 2023
main

Map It 2023 〉 iPhone 14 Pro — Finished running Map It 2023 on iPhone 14 Pro

ContentView.swift

Map It 2023 〉 Map It 2023 〉 ContentView.swift 〉 body

- Map It 2023
  - Map It 2023
    - Map_It_2023App.swift
    - ContentView.swift M
    - Assets.xcassets
    - Preview Content

```
//
//  ContentView.swift
//  Map It 2023
//
//  Created by Stephen Liddle on 9/5/23.
//

import SwiftUI
import MapKit

struct ContentView: View {
    private var formatter = NumberFormatter()

    @State private var latitudeValue = "40.2503"
    @State private var longitudeValue = "-111.65231"
    @State private var cameraPosition = MapCameraPosition.region(
        MKCoordinateRegion(
            center: CLLocationCoordinate2D(lat
            span: MKCoordinateSpan(latitudeDe
        )
    )

    var body: some View {
        VStack {
            HStack {
                TextField("Latitude", text: $latitudeValue)
                TextField("Longitude", text: $longitudeValue)
                Button("Map It") {
                    updateMapRegion()
                }
            }
            .padding(.horizontal, 20)

            Map(position: $cameraPosition)
                .mapStyle(MapStyle.hybrid(showsTraffic: true))
                .mapControls {
                    MapScaleView()
                }
                .edgesIgnoringSafeArea(.all)
        }
    }
```

43 characters

Preview (Line 62)

Text Field
Text: Latitude
$latitudeValue

Modifiers

Accessibility
Label: Inherited
Identifier: Inherited

Padding
Padding: Inherited

Frame
Size: Inher (Width) Inher (Height)

Add Modifier

Navigator

Editor

Utilities

Debug area

Auto | Filter | Executable | Previews | Filter

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Fall 2023

Map It 2023
main

Map It 2023 〉 iPhone 14 Pro — Finished running Map It 2023 on iPhone 14 Pro

ContentView.swift

Map It 2023 〉 Map It 2023 〉 ContentView.swift 〉 body

- Map It 2023
  - Map It 2023
    - Map_It_2023App.swift
    - ContentView.swift M
    - Assets.xcassets
    - Preview Content

```swift
//
//  ContentView.swift
//  Map It 2023
//
//  Created by Stephen Liddle on 9/5/23.
//

import SwiftUI
import MapKit

struct ContentView: View {
    private var formatter = NumberFormatter()

    @State private var latitudeValue = "40.2503"
    @State private var longitudeValue = "-111.65231"
    @State private var cameraPosition = MapCameraPosition.region(
        MKCoordinateRegion(
            center: CLLocationCoordinate2D(latitude: 40, longitude: -111),
            span: MKCoordinateSpan(latitudeDelta: 100, longitudeDelta: 100)
        )
    )

    var body: some View {
        VStack {
            HStack {
                TextField("Latitude", text: $latitudeValue)
                TextField("Longitude", text: $longitudeValue)
                Button("Map It") {
                    updateMapRegion()
                }
            }
            .padding(.horizontal, 20)

            Map(position: $cameraPosition)
                .mapStyle(MapStyle.hybrid(showsTraffic: true))
                .mapControls {
                    MapScaleView()
                }
                .edgesIgnoringSafeArea(.all)
        }
    }
```

43 characters

Preview (Line 62)

Show/hide Code Review Editor

Hide/show Utilities Pane

Text Field
Text: Latitude
$latitudeValue

Modifiers

Accessibility
Label: Inherited
Identifier: Inherited

Padding

Width Height

Add Modifier

Auto ⌃ | Filter | Executable | Previews | Filter

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Fall 2023

Code Review Editor shows changes between versions (remember to commit often)

Here we've selected the Code Review Editor...

...with Side by Side Comparison

Select another commit to compare

Map It 2023
main

Map It 2023 〉 iPhone 14 Pro

Finished running Map It 2023 on iPhone 14 Pro

- Map It 2023
  - Map It 2023
    - Map_It_2023App.swift
    - ContentView.swift M
    - Assets.xcassets
    - Preview Content

ContentView.swift

Map It 2023 〉 Map It 2023 〉 ContentView.swift 〉 body

```swift
//
//  ContentView.swift
//  Map It 2023
//
//  Created by Stephen Liddle on 9/5/23.
//

import SwiftUI
import MapKit

struct ContentView: View {
    private var formatter = NumberFormat

    @State private var latitudeValue = "40.2503"
    @State private var longitudeValue = "-111.65231"
    @State private var cameraPosition =
        MapCameraPosition.region(
        MKCoordinateRegion(
            center: CLLocationCoordinate2D(latitude: 40,
                longitude: -111),
            span: MKCoordinateSpan(latitudeDelta: 100,
                longitudeDelta: 100)
        )
    )

    var body: some View {
        VStack {
            HStack {
                TextField("Latitude", text:
                    $latitudeValue)
                TextField("Longitude", text:
                    $longitudeValue)
                Button("Map It") {
                    updateMapRegion()
                }
            }
            .padding(.horizontal, 20)

            Map(position: $cameraPosition)
                .mapStyle(MapStyle.hybrid(showsTraffic:
                    true))
                .mapControls {
                    MapScaleView()
                }
                .edgesIgnoringSafeArea(.all)
        }
    }

    private func updateMapRegion() {
```

```swift
tView.swift
2023

d by Stephen Liddle on 9/5/23.

ftUI
Kit

ten
e v

    @State pr
    @State pr
    @State pr
        cente
            lo
        span: MKCoordinateSpan(latitudeDelta: 100,
            longitudeDelta: 100)
    )

    var body: some View {
        VStack {
            HStack {
                TextField("Latitude", text: $latitudeValue)
                TextField("Longitude", text:
                    $longitudeValue)
                Button("Map It") {
                    updateMapRegion()
                }
            }
            .padding(.horizontal, 20)

            Map(coordinateRegion: $mapRegion)
                .edgesIgnoringSafeArea(.all)
                .onAppear {
                    updateMapAppearance()
                }
        }
    }

    private func u
        let map =

        map.mapType = .satellite
        map.showsTraffic = true
        map.showsBuildings = true
        map.showsScale = true
```

43 characters | 5 changes | Uncommitted Changes | Last Commit

Identity and Type

Name: ContentView.swift
Type: Default - Swift Source
Location: Relative to Group
ContentView.swift
Full Path: /Users/Liddle/Documents/IS/IS 543/IS 543 Fall 2023/In-Class Examples/Map It 2023/Map It 2023/ContentView.swift

Text Settings

Text Encoding: No Explicit Encoding
Line Endings: No Explicit Line Endings
Indent Using: Spaces
Widths: 4 Tab, 4 Indent
Wrap lines

Map It 2023
main

Map It 2023 〉 iPhone 14 Pro — Finished running Map It 2023 on iPhone 14 Pro

ContentView.swift

Map It 2023 〉 Map It 2023 〉 ContentView.swift 〉 body

- Map It 2023
  - Map It 2023
    - Map_It_2023App.swift
    - ContentView.swift M
    - Assets.xcassets
    - Preview Content

Project navigator

Navigator pane

```
//
//  Cont
//  Map I
//
//  Create
//

import SwiftUI
import MapKit

struct ContentView: View {
    private var formatter = NumberFormatter()

    @State private var latitudeValue = "40.2503"
    @State private var longitudeValue = "-111.65231"
    @State private var cameraPosition = MapCameraPosition.region(
        MKCoordinateRegion(
            center: CLLocationCoordinate2D(latitude: 40, longitude: -111),
            span: MKCoordinateSpan(latitudeDelta: 100, longitudeDelta: 100)

    )

    V

            HStack {
                TextField("Latitude", text: $latitudeValue)
                TextField("Longitude", text: $longitudeValue)
                Button("Map It") {
                    updateMapRegion()
                }
            }
            .padding(.horizontal, 20)

            Map(position: $cameraPosition)
                .mapStyle(MapStyle.hybrid(showsTraffic: true))
                .mapControls {
                    MapScaleView()
                }
                .edgesIgnoringSafeArea(.all)
        }
    }

    private func updateMapRegion() {
        withAnimation {
            if let latitude = formatter.number(from: latitudeValue),
               let longitude = formatter.number(from: longitudeValue) {

                cameraPosition = MapCameraPosition.region(
                    MKCoordinateRegion(
```

Preview (Line 62)

Text Field
Text: Latitude
$latitudeValue

Modifiers
Accessibility
Label: Inherited
Identifier: Inherited
Padding
Padding: Inherited
Frame
Size: Inher Width, Inher Height
Add Modifier

43 characters

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Fall 2023

Map It 2023
main

Map It 2023 › iPhone 14 Pro — Finished running Map It 2023 on iPhone 14 Pro

Changes | Repositories

Map It 2023 main
- Uncommitted Changes 1
  - ContentView.swift M

Source Control navigator

ContentView.swift

Map It 2023 › Map It 2023 › ContentView.swift › body

```swift
//
//  ContentView.swift
//  Map It 2023
//
//  Created by Stephen Liddle on 9/5/23.
//

import SwiftUI
import MapKit

struct C
    pri

    @State private var latitudeValue = "40.2503"
    @State private var longitudeValue = "-111.65231"
    @State private var cameraPosition = MapCameraPosition.region(
        MKCoordinateRegion(
            center: CLLocationCoordinate2D(latitude: 40, longitude: -111),
            span: MKCoordinateSpan(latitudeDelta: 100, longitudeDelta: 100)
        )
    )

    var body: some View {
        VStack {
            HStack {
                TextField("Latitude", text: $latitudeValue)
                TextField("Longitude", text: $longitudeValue)
                Button("Map It") {
                    updateMapRegion()
                }
            }
            .padding(.horizontal, 20)

            Map(position: $cameraPosition)
                .mapStyle(MapStyle.hybrid(showsTraffic: true))
                .mapControls {
                    MapScaleView()
                }
                .edgesIgnoringSafeArea(.all)
        }
    }

    private func updateMapRegion() {
        withAnimation {
            if let latitude = formatter.number(from: latitudeValue),
               let longitude = formatter.number(from: longitudeValue) {

                cameraPosition = MapCameraPosition.region(
                    MKCoordinateRegion(
```

Preview (Line 62)

Text Field
Latitude
Text $latitudeValue

Modifiers

Accessibility
Label Inherited
Identifier Inherited

Padding
Padding Inherited

Frame
Size Inher Width Inher Height

Add Modifier

43 characters

IS 543
Fall 2023

Map It 2023
main

Map It 2023 〉 iPhone 14 Pro — Finished running Map It 2023 on iPhone 14 Pro

ContentView.swift

Map It 2023 〉 Map It 2023 〉 ContentView.swift 〉 body

ContentView.swift: 26
TextField("Latitude", text: $latitudeValue)

ContentView.swift: 34
Map(position: $cameraPosition)

Bookmark navigator

```
//
                                                    3.

import SwiftUI
import MapKit

struct ContentView: View {
    private var formatter = NumberFormatter()

    @State private var latitudeValue = "40.2503"
    @State private var longitudeValue = "-111.65231"
    @State private var cameraPosition = MapCameraPosition.region(
        MKCoordinateRegion(
            center: CLLocationCoordinate2D(latitude: 40, longitude: -111),
            span: MKCoordinateSpan(latitudeDelta: 100, longitudeDelta: 100)
        )
    )

    var body: some View {
        VStack {
            HStack {
                TextField("Latitude", text: $latitudeValue)
                TextField("Longitude", text: $longitudeValue)
                Button("Map It") {
                    updateMapRegion()
                }
            }
            .padding(.horizontal, 20)

            Map(position: $cameraPosition)
                .mapStyle(MapStyle.hybrid(showsTraffic: true))
                .mapControls {
                    MapScaleView()
                }
                .edgesIgnoringSafeArea(.all)


                                    teMapRegion() {
                                    {
                                    titude = formatter.number(from: latitudeValue),
                                    longitude = formatter.number(from: longitudeValue) {

                                    cameraPosition = MapCameraPosition.region(
                                        MKCoordinateRegion(
```

Use this menu to create bookmarks

Preview (Line 62)

No Selection

Line: 34 Col: 35

Filter

IS 543
Fall 2023

Find navigator

Add another editor on the right

Modify editor properties

Minimap of file being edited

Canvas pane

Map It 2023
main

Map It 2023 〉 iPhone 14 Pro

Finished running Map It 2023 on iPhone 14 Pro

ContentView.swift

Map It 2023 〉 Map It 2023 〉 ContentView.swift 〉 body

Find 〉 Text 〉 Containing

latitude

In Project Ignoring Case

10 results in 1 file

ContentView.swift Map It 2023

- @State private var **latitude**Value = "40.2503"
- center: CLLocationCoordinate2D(**latitude**: 40, longitude: -11...
- span: MKCoordinateSpan(**latitude**Delta: 100, longitudeDelta: 100)
- TextField("**Latitude**", text: $latitudeValue)
- TextField("Latitude", text: $**latitude**Value)
- if let **latitude** = formatter.number(from: latitudeValue),
- if let latitude = formatter.number(from: **latitude**Value),
- **latitude**: latitude.doubleValue,
- latitude: **latitude**.doubleValue,
- span: MKCoordinateSpan(**latitude**Delta: 0.0015, longitudeDelta: 0.0015)

Filter

```
//
                                    /23.

import SwiftUI
import MapKit

struct ContentView: View {
    private var formatter = NumberFormatter()

    @State private var latitudeValue = "40.2503"
    @State private var longitudeValue = "-111.65231"
    @State private var cameraPosition = MapCameraPosition.region(
        MKCoordinateRegion(
            center: CLLocationCoordinate2D(latitude: 40, longitude:
                -111),
            span: MKCoordinateSpan(latitudeDelta: 100,
                longitudeDelta: 100)
        )
    )

    var body: some View {
        VStack {
            HStack {
                TextField("Latitude", text: $latitudeValue)
                TextField("Longitude", text: $longitudeValue)
                Button("Map It") {
                    updateMapRegion()
                }
            }
            .padding(.horizontal, 20)

            Map(position: $cameraPosition)
                .mapStyle(MapStyle.hybrid(showsTraffic: true))
                .mapControls {
                    MapScaleView()
                }
                .edgesIgnoringSafeArea(.all)
        }
    }

    private func updateMapRegion() {
        withAnimation {
            if let latitude = formatter.number(from: latitudeValue),
               let longitude = formatter.number(from:
                   longitudeValue) {
```

Preview (Line 62)

No Selection

1 line

IS 543
Fall 2023

Map It 2023
main

Map It 2023 〉 iPhone 14 Pro

Build **Failed** | Today at 10:46 PM

ContentView.swift

Map It 2023 〉 Map It 2023 〉 ContentView.swift 〉 cameraPosition

Map It 2023 1 issue
- ContentView.swift
  - Cannot find 'Mappy' in scope

Issue navigator

Never turn in a project with warnings or errors!

```
//
                                                    /5/23.

import SwiftUI
import MapKit

struct ContentView: View {
    private var formatter = NumberFormatter()

    @State private var latitudeValue = "40.2503"
    @State private var longitudeValue = "-111.65231"
    @State private var cameraPosition = MapCameraPosition.region(
        MKCoordinateRegion(
            center: CLLocationCoordinate2D(latitude: 40, longitude: -111),
            span: MKCoordinateSpan(latitudeDelta: 100, longitudeDelta: 100)
        )
    )

    var body: some View {
        VStack {
            HStack {
                TextField("Latitude", text: $latitudeValue)
                TextField("Longitude", text: $longitudeValue)
                Button("Map It") {
                    updateMapRegion()
                }
            }
            .padding(.horizontal, 20)

            Mappy(position: $cameraPosition)                    Cannot find 'Mappy' in scope
                .mapStyle(MapStyle.hybrid(showsTraffic: true))
                .mapControls {
                    MapScaleView()
                }
                .edgesIgnoringSafeArea(.all)
        }
    }

    private func updateMapRegion() {
        withAnimation {
            if let latitude = formatter.number(from: latitudeValue),
               let longitude = formatter.number(from: longitudeValue) {

                cameraPosition = MapCameraPosition.region(
                    MKCoordinateRegion(
```

paused

-111.65231 Map It

NORTH AMERICA
North Pacific Ocean
South Pacific Ocean
Maps Legal

Automatic – iPhone 14 Pro

Line: 18 Col: 75

IS 543
Fall 2023

Map It 2023-Test
main

Map It 2023-Test 〉 iPhone 14 Pro

Map It 2023-Test: **Ready** | Today at 10:52 PM

Map_It_2023_TestTests.swift

Map It 2023-Test 〉 Map It 2023-TestTests 〉 Map_It_2023_TestTests.swift 〉 testExample()

- Map It 2023-Test
  - Map It 2023-Test
    - Map_It_2023_TestApp.swift
    - ContentView.swift M
    - Assets.xcassets
    - Preview Content
  - Map It 2023-TestTests
    - Map_It_2023_TestTests.swift
  - Map It 2023-TestUITests
    - Map_It_2023_TestUITests....
    - Map_It_2023_TestUITestsL...

Test navigator

```
//
                                                    6/23.

import XCTest
@testable import Map_It_2023_Test

final class Map_It_2023_TestTests: XCTestCase {

    override func setUpWithError() throws {
        // Put setup code here. This method is called before the invocation of each test method in the class.
    }

    override func tearDownWithError() throws {
        // Put teardown code here. This method is called after the invocation of each test method in the class.
    }

    func testExample() throws {
        // This is an example of a functional test case.
        // Use XCTAssert and related functions to verify your tests produce the correct results.
        // Any test you write for XCTest can be annotated as throws and async.
        // Mark your test throws to produce an unexpected failure when your test encounters an uncaught error.
        // Mark your test async to allow awaiting for asynchronous code to complete. Check the results with assertions afterwards.
    }

    func testPerformanceExample() throws {
        // This is an example of a performance test case.
        self.measure {
            // Put the code you want to measure the time of here.
        }
    }

}
```

Line: 21 Col: 10

Map It 2023
main

Map It 2023 〉 iPhone 14 Pro — Paused Map It 2023 on iPhone 14 Pro

ContentView.swift

Map It 2023 〉 Map It 2023 〉 ContentView.swift 〉 ContentView

Map It 2023 PID 9477
CPU 16%
Memory 83.4 MB
Disk Zero KB/s
Network Zero KB/s

Thread 1 Queue: c...ad (serial)
0 ContentView.updateMap...
1 closure #1 in closure #1 in...
2 __lldb_unnamed_symbo...
3 __lldb_unnamed_symbo...
4 __lldb_unnamed_symbo...
5 __lldb_unnamed_symbo...
6 __lldb_unnamed_symbo...
7 __lldb_unnamed_symbo...
8 __lldb_unnamed_symbo...
9 __lldb_unnamed_symbo...
10 __lldb_unnamed_symb...
11 __lldb_unnamed_symb...
12 __lldb_unnamed_symb...
13 __lldb_unnamed_symb...
14 __lldb_unnamed_symb...
15 __lldb_unnamed_symb...
16 __lldb_unnamed_symb...
17 __lldb_unnamed_symb...
18 -[UIGestureRecognizer...
19 -[UITouchesEvent _send...
20 -[UIGestureEnvironment...
21 -[UIGestureEnvironment...
22 -[UIWindow sendEvent:]
23 -[UIApplication sendEve...
24 __dispatchPreprocesse...
25 __processEventQueue
26 __eventFetcherSourceC...
27 __CFRUNLOOP_IS_CAL...
28 __CFRunLoopDoSource0
29 __CFRunLoopDoSources0
30 __CFRunLoopRun
31 CFRunLoopRunSpecific
32 GSEventRunModal
33 -[UIApplication _run]
34 UIApplicationMain

```
11  struct ContentView: View {
                                  e", text: $latitudeValue)
27              TextField("Longitude", text: $longitudeValue)
28
29
31
32
33
34          Map(position: $cameraPosition)
35                      Style.hybrid(showsTraffic: true))
36
37                      ew()
38
39                      gSafeArea(.all)
40      }
41  }
42
43  private func updateMapRegion() {
44      withAnimation {                                   Thread 1: breakpoint 1.1 (1)
45          if let latitude = formatter.number(from: latitudeValue),
46             let longitude = formatter.number(from: longitudeValue) {
47
48              cameraPosition = MapCameraPosition.region(
49                  MKCoordinateRegion(
50                      center: CLLocationCoordinate2D(
51                          latitude: latitude.doubleValue,
52                          longitude: longitude.doubleValue
53                      ),
54                      span: MKCoordinateSpan(latitudeDelta: 0.0015, longitudeDelta: 0.0015)
55                  )
56
57
58      }
59  }
60 }
61
```

Map It 2023 〉 Thread 1 〉 0 ContentView.updateMapRegion() — Line: 11

self (Map_It_2023.ContentView)
column = (Int) 1
fileID (String)
line = (Int) 62

(lldb)

Executable Previews

Identity and Type
Name ContentView.swift
Type Default - Swift Source
Location Relative to Group
ContentView.swift
Full Path /Users/Liddle/Documents/IS/IS 543/IS 543 Fall 2023/In-Class Examples/Map It 2023/Map It 2023/ContentView.swift

On Demand Resource Tags
Only resources are taggable

Target Membership
Map It 2023

Text Settings
Text Encoding No Explicit Encoding
Line Endings No Explicit Line Endings
Indent Using Spaces
Widths 4 Tab 4 Indent
Wrap lines

Debug navigator

Current stack trace

Breakpoint

Current point of execution

Debugger controls

Variables View

Console

Hide/show panes

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Fall 2023

Map It 2023
main

Map It 2023 〉 iPhone 14 Pro — Paused Map It 2023 on iPhone 14 Pro

ContentView.swift

Map It 2023 〉 Map It 2023 〉 ContentView.swift 〉 ContentView

- Map It 2023 1 Breakpoint
  - ContentView.swift
    - updateMapRegion()... 44
      - Map_It_2023.Conten...
      - closure #1 () -> () in...

Breakpoint navigator

```
11  struct ContentView: View {
23      var body: some View {
24          VStack {
25              ha
26
27
28
29
30              }
31          }
32          .padding(.horizontal, 20)
33
34          Map(position: $cameraPosition)
35              .mapStyle(MapStyle.hybrid(showsTraffic: true))
36              .mapControls {
37                  MapScaleView()
38              }
39              .edgesIgnoringSafeArea(.all)
40      }
41  }
42
43  private func updateMapRegion() {
44      withAnimation {                                   Thread 1: breakpoint 1.1 (1)
45          if let latitude = formatter.number(from: latitudeValue),
46             let longitude = formatter.number(from: longitudeValue) {
47
48              cameraPosition = MapCameraPosition.region(
49                  MKCoordinateRegion(
50                      center: CLLocationCoordinate2D(
51                          latitude: latitude.doubleValue,
52                          longitude: longitude.doubleValue
53                      ),
54                      span: MKCoordinateSpan(latitudeDelta: 0.0015, longitudeDelta: 0.0015)
55                  )
56              )
57          }
58      }
59  }
60  }
61
62  #Preview {
```

Map It 2023 〉 Thread 1 〉 0 ContentView.updateMapRegion() — Line: 11 Col: 10

- self (Map_It_2023.ContentView)
- column = (Int) 1
- fileID (String)
- line = (Int) 62

(lldb)

Executable | Previews

Identity and Type

Name: ContentView.swift
Type: Default - Swift Source
Location: Relative to Group
ContentView.swift
Full Path: /Users/Liddle/Documents/IS/IS 543/IS 543 Fall 2023/In-Class Examples/Map It 2023/Map It 2023/ContentView.swift

On Demand Resource Tags

Only resources are taggable

Target Membership

Map It 2023

Text Settings

Text Encoding: No Explicit Encoding
Line Endings: No Explicit Line Endings
Indent Using: Spaces
Widths: 4 Tab, 4 Indent
Wrap lines

Map It 2023
main

Map It 2023 〉 iPhone 14 Pro — Running Map It 2023 on iPhone 14 Pro

ContentView.swift | Build for Previews Map It 2023 - Log

Map It 2023 〉 Build for Previews 〉 No Selection

Local | Cloud

- Map It 2023
  - Run Today, 10:54 PM
    - Console
    - Launch
    - Build
    - Build for Pre... Today, 10:53 PM
    - Build for Pre... Today, 10:53 PM
    - Build for Pre... Today, 10:52 PM
    - Build Today, 10:51 PM
    - Build Today, 10:50 PM
    - Build Today, 10:46 PM
    - Build for... Yesterday, 3:39 PM
    - Build for... Yesterday, 3:39 PM
    - Build for... Yesterday, 3:39 PM
    - Build for... Yesterday, 3:39 PM
    - Build for... Yesterday, 3:39 PM
    - Build for... Yesterday, 3:39 PM
    - Build for... Yesterday, 3:37 PM
    - Build f... Yesterday, 3:36 PM
    - Build f... Yesterday, 3:36 PM
    - Build f... Yesterday, 3:36 PM
    - Build f... Yesterday, 3:36 PM
    - Build f... Yesterday, 3:36 PM
    - Build f... Yesterday, 3:36 PM
    - Build f... Yesterday, 3:35 PM
    - Build f... Yesterday, 3:35 PM
    - Build f... Yesterday, 3:35 PM
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    - Build f... Yesterday, 3:35 PM
    - Build f... Yesterday, 3:35 PM
    - Build f... Yesterday, 3:35 PM
    - Build f... Yesterday, 3:34 PM
    - Build f... Yesterday, 3:34 PM
    - Build f... Yesterday, 3:34 PM
    - Build f... Yesterday, 3:34 PM
    - Build f... Yesterday, 3:34 PM
    - Build f... Yesterday, 3:34 PM
    - Build f... Yesterday, 3:34 PM
    - Build f... Yesterday, 3:33 PM
    - Build f... Yesterday, 2:57 PM

All | Recent | All Messages | All Issues | Errors Only | Export... | Filter

Write Map It 2023-generated-files.hmap 0.1 seconds
Write Map It 2023-target-headers.hmap 0.1 seconds
Write Map It 2023-all-target-headers
Write Map It 2023-project-headers
Compile asset catalogs 0.1 seconds
Generate asset symbols 0.1 seconds
Write Map It 2023.SwiftFileList
Write Map It 2023-OutputFileMap.json (arm64) 0.1 seconds
Write Map It 2023_const_extract_protocols.json (arm64) 0.1 seconds
Write Map It 2023.LinkFileList (arm64) 0.1 seconds
Planning Swift module Map_It_2023 (arm64) 0.1 seconds
Process empty-Map It 2023.plist 0.1 seconds
Compiling Map_It_2023App.swift 0.2 seconds
  Compile Map_It_2023App.swift (arm64) 0.1 seconds
Emitting module for Map_It_2023 0.2 seconds
Compiling GeneratedAssetSymbols.swift 0.2 seconds
  Compile GeneratedAssetSymbols.swift (arm64) 0.1 seconds
Compiling ContentView.swift 0.2 seconds
  Compile ContentView.swift (arm64) 0.2 seconds
Discovering Swift tasks after 'Compiling Map_It_2023App.swift' 0.1 seconds
Discovering Swift tasks after 'Compiling GeneratedAssetSymbols.swift' 0.1 seconds
Discovering Swift tasks after 'Emitting module for Map_It_2023' 0.1 seconds
Unblock downstream dependents of Map It 2023 (arm64) 0.1 seconds
Merge Objective-C generated interface headers 0.1 seconds
Copy Map_It_2023.swiftdoc (arm64) 0.1 seconds
Copy Map_It_2023.abi.json (arm64) 0.1 seconds
Copy Map_It_2023.swiftsourceinfo (arm64) 0.1 seconds
Copy Map_It_2023.swiftmodule (arm64) 0.1 seconds
Discovering Swift tasks after 'Compiling ContentView.swift' 0.1 seconds
Compile Map It 2023 (arm64) 0.1 seconds
Link Map It 2023 (arm64) 0.1 seconds
Copy Swift standard libraries into Map It 2023.app 0.1 seconds
Extract app intents metadata 0.1 seconds
  Metadata extraction skipped. No AppIntents.framework dependency found.
Generate SSU asset files 0.1 seconds
Sign Map It 2023.app 0.1 seconds
Register execution policy exception for Map It 2023.app 0.1 seconds
Validate Map It 2023.app 0.1 seconds
Touch Map It 2023.app 0.1 seconds

Build succeeded 9/6/23, 10:53 PM 0.8 seconds
No issues

Map It 2023

Auto | Filter | Executable | Previews | Filter

Not Applicable

Report navigator

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Fall 2023

Map It 2023
main

Map It 2023 〉 iPhone 14 Pro

Running Map It 2023 on iPhone 14 Pro

ContentView.swift

Map It 2023 〉 Map It 2023 〉

- Map It 2023
  - Map It 2023
    - Map_It_2023App.swift
    - ContentView.swift M
    - Assets.xcassets
    - Preview Content
  - Products
  - Frameworks

```
11  struct ContentVie
23      var body: som
24          VStack {
25              HStac
26                  T
27                  T
28                  B
29
30                  }
31              }
32              .padc
33
34              Map(p
35                  .
36                  .
37
38                  }
39                  .
40          }
41      }
42
43      private func
44          withAnima
45              if le
46                  le
47
48                  c
49
50
51
52
53
54
55
56                  )
57              }
58          }
59      }
60  }
61
62  #Preview {
63      ContentView()
64  }
65
```

Views

Controls

- Button
- Color Picker
- Date Picker
- Disclosure Group
- Edit Button
- Form
- Gauge
- Group Box
- Label
- Labeled Content
- Link
- List
- Menu
- Multi Date Picker

Button

A control that initiates an action.

```
struct Button<Label> where Label : View
```

You create a button by providing an action and a label. The action is either a method or closure property that does something when a user clicks or taps the button. The label is a view that describes the button's action — for example, by showing text, an icon, or both.

The label of a button can be any kind of view, such as a Text view for text-only labels:

```
Button(action: signIn) {
    Text("Sign In")
}
```

Or a Label view, for buttons with both a title and an icon:

```
Button(action: signIn) {
    Label("Sign In", systemImage: "arrow.up")
}
```

For those common cases, you can also use the convenience initializers that take a title string or LocalizedStringKey as their first parameter, and optionally a system image name or ImageResource as their second parameter, instead of a trailing closure:

```
Button("Sign In", systemImage: "arrow.up", action: signIn)
```

Prefer to use these convenience initializers, or a Label view, when providing both a title and an icon. This allows the button to dynamically adapt its appearance to render its title and icon correctly in containers such as toolbars and menus. For example, on iOS, buttons only display their icons by default when placed in toolbars, but show both a leading title and trailing icon in menus. Defining labels this way also helps with accessibility — for example, applying the labelStyle(_:) modifier with an iconOnly style to the button will cause it to only visually display its icon, but still use its title to describe the button in accessibility modes like VoiceOver:

```
Button("Sign In", systemImage: "arrow.up", action: signIn)
    .labelStyle(.iconOnly)
```

Avoid labels that only use images or exclusively visual components without an accessibility label.

How the user activates the button varies by platform:

- In iOS and watchOS, the user taps the button.
- In macOS, the user clicks the button.
- In tvOS, the user presses "select" on an external remote, like the Siri Remote, while focusing on the button.

The appearance of the button depends on factors like where you place it, whether you assign it a role, and how you style it.

Preview (Line 62)

Library button

Views library

Automatic – iPhone 14 Pro

Map It 2023

Line: 25 Col: 21

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Map It 2023
main

Map It 2023 〉 iPhone 14 Pro

Running Map It 2023 on iPhone 14 Pro

ContentView.swift

Map It 2023 〉 Map It 2023 〉

- Map It 2023 M
  - Map It 2023
    - Map_It_2023App.swift
    - ContentView.swift M
    - Assets.xcassets
    - Preview Content
  - Products
  - Frameworks

```
11  struct ContentVie
23      var body: som
24          VStack {
25              HStac
26                  T
27                  T
28                  B
29
30              }
31          }
32          .padd
33
34          Map(p
35              .
36              .
37
38              }
39              .
40      }
41  }
42
43  private func
44      withAnima
45          if le
46              le
47
48              c
49
50
51
52
53
54
55
56              )
57          }
58      }
59  }
60  }
61
62  #Preview {
```

Snippets

Swift

- API Availability Check
- Closure Expression
- Closure Stored Constant Decla...
- Computed Variable Get and Se...
- Computed Variable Get Declar...
- Convenience Initializer Declara...
- Defer Statement
- Deinitializer Declaration
- Deprecated
- Deprecated with version
- Do-Catch Statement
- Enumerated Type Declaration
- For Statement
- Function Statement

Closure Expression

A set of statements that can be reused and passed to other code.

```
{ (parameters) -> return type in
    statements
}
```

Language	Swift
Platform	All
Completion	closure
Availability	Function, Method, or Top Level

Available libraries change depending on context

Snippets library

Identity and Type

Name ContentView.swift

ContentView.swift

On Demand Resource Tags

Only resources are taggable

Target Membership

Map It 2023

Text Settings

Text Encoding No Explicit Encoding

Line Endings No Explicit Line Endings

Indent Using Spaces

Widths 4 Tab 4 Indent

Wrap lines

Map It 2023

Line: 25 Col: 21

Auto Filter Executable Previews Filter

IS 543
Fall 2023

Map It 2023
main

Map It 2023 〉 iPhone 14 Pro — Running Map It 2023 on iPhone 14 Pro

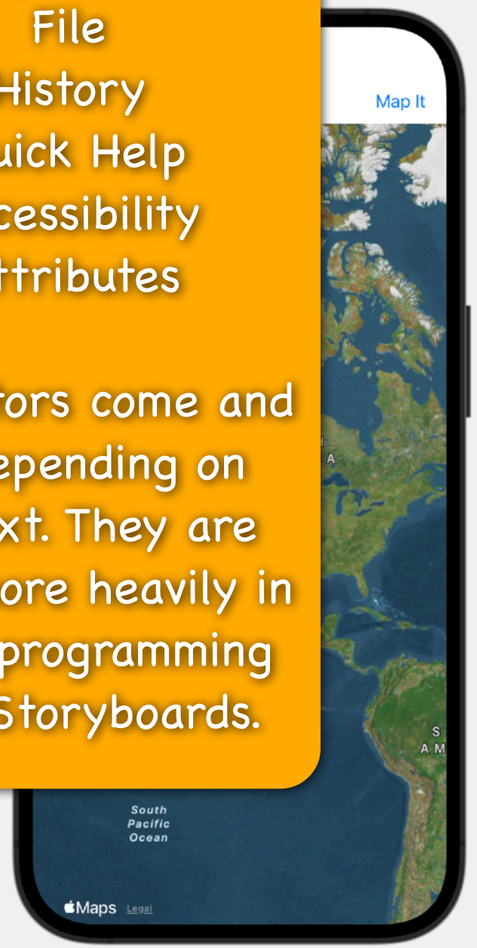
ContentView.swift

Map It 2023 〉 Map It 2023 〉 ContentView.swift 〉 body

- Map It 2023 M
  - Map It 2023
    - Map_It_2023App.swift
    - ContentView.swift M
    - Assets.xcassets
    - Preview Content
  - Products
  - Frameworks

```swift
//
//  ContentView.swift
//  Map It 2023
//
//  Created by Stephen Liddle on 9/5/23.
//

import SwiftUI
import MapKit

struct ContentView: View {
    private var formatter = NumberFormatter()

    @State private var latitudeValue = "40.2503"
    @State private var longitudeValue = "-111.65231"
    @State private var cameraPosition = MapCameraPosition.region(
        MKCoordinateRegion(
            center: CLLocationCoordinate2D(latitude: 40, longitude: -111
            span: MKCoordinateSpan(latitudeDelta: 100, longitudeDelta: 1
        )
    )

    var body: some View {
        VStack {
            HStack {
                TextField("Latitude", text: $latitudeValue)
                TextField("Longitude", text: $longitudeValue)
                Button("Map It") {
                    updateMapRegion()
                }
            }
            .padding(.horizontal, 20)

            Map(position: $cameraPosition)
                .mapStyle(MapStyle.hybrid(showsTraffic: true))
                .mapControls {
                    MapScaleView()
                }
                .edgesIgnoringSafeArea(.all)
        }
    }

    private func updateMapRegion() {
        withAnimation {
            if let latitude = formatter.number(from: latitudeValue),
               let longitude = formatter.number(from: longitudeValue) {

                cameraPosition = MapCameraPosition.region(
                    MKCoordinateRegion(
```

Preview (Line 62)



Inspectors:
File
History
Quick Help
Accessibility
Attributes

Inspectors come and go depending on context. They are used more heavily in UIKit programming with Storyboards.

Identity and Type

Name: ContentView.swift
Type: Default - Swift Source
Location: Relative to Group
ContentView.swift
Full Path: /Users/Liddle/Documents/IS/IS 543/IS 543 Fall 2023/In-Class Examples/Map It 2023/Map It 2023/ContentView.swift

On Demand Resource Tags

Only resources are taggable

Target Membership

☑ Map It 2023

Text Settings

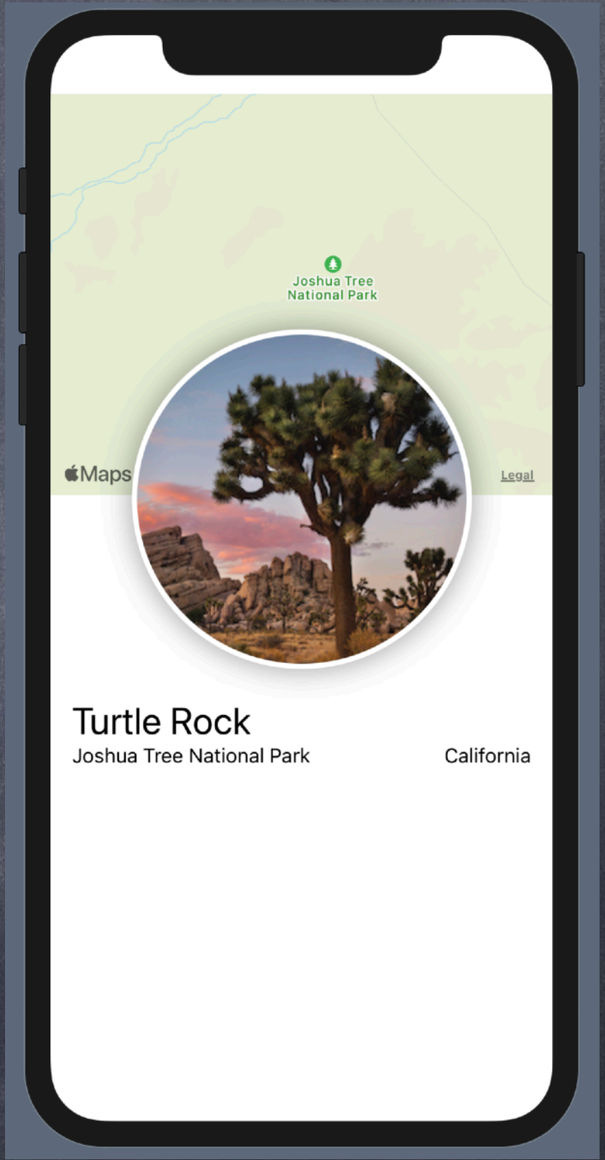
Text Encoding: No Explicit Encoding
Line Endings: No Explicit Line Endings
Indent Using: Spaces
Widths: 4 Tab, 4 Indent
☑ Wrap lines

Map It 2023 — Line: 25 Col: 21

IS 543
Fall 2023

You Do the Demo

- Let's demo
  But I'd like a student to be our keyboardist if possible
  Is anyone willing to share their screen and drive the demo
  while I explain what to do?



MVC vs. Declarative UI

- Model View Controller (MVC) is the traditional iOS app architecture
  - It is orderly, well understood, and works reasonably well
  - Build an app using a storyboard, combining potentially many coordinating MVC units
  - But it's easy to create massive controllers, and that's not great architecture
  - Many developers promote MVVM to clean up the "Massive View Controller" problem
- SwiftUI follows the "Declarative UI" architectural pattern
  - You manage the state of an app and then declare a UI specification that renders updates to the UI whenever the state changes
  - This is the React approach and the Google Flutter approach
  - MVVM is a natural pattern for SwiftUI
- Declarative vs. Imperative UI:
  - With imperative, you call methods on widgets when events occur and the UI needs to change
  - With declarative, you make state changes, then the framework decides which parts of the UI need to be modified

Why Declarative UI?

- Managing state changes can be tricky

  Lots of moving parts:

  - User performs touch event
  - Network request starts or finishes
  - Timer fires
  - Operation fails or succeeds

  And from all that you want to change the UI to reflect the state of the app

  Transitions from state to state can be very complex

  Order dependencies and concurrent processing can cause interesting bugs

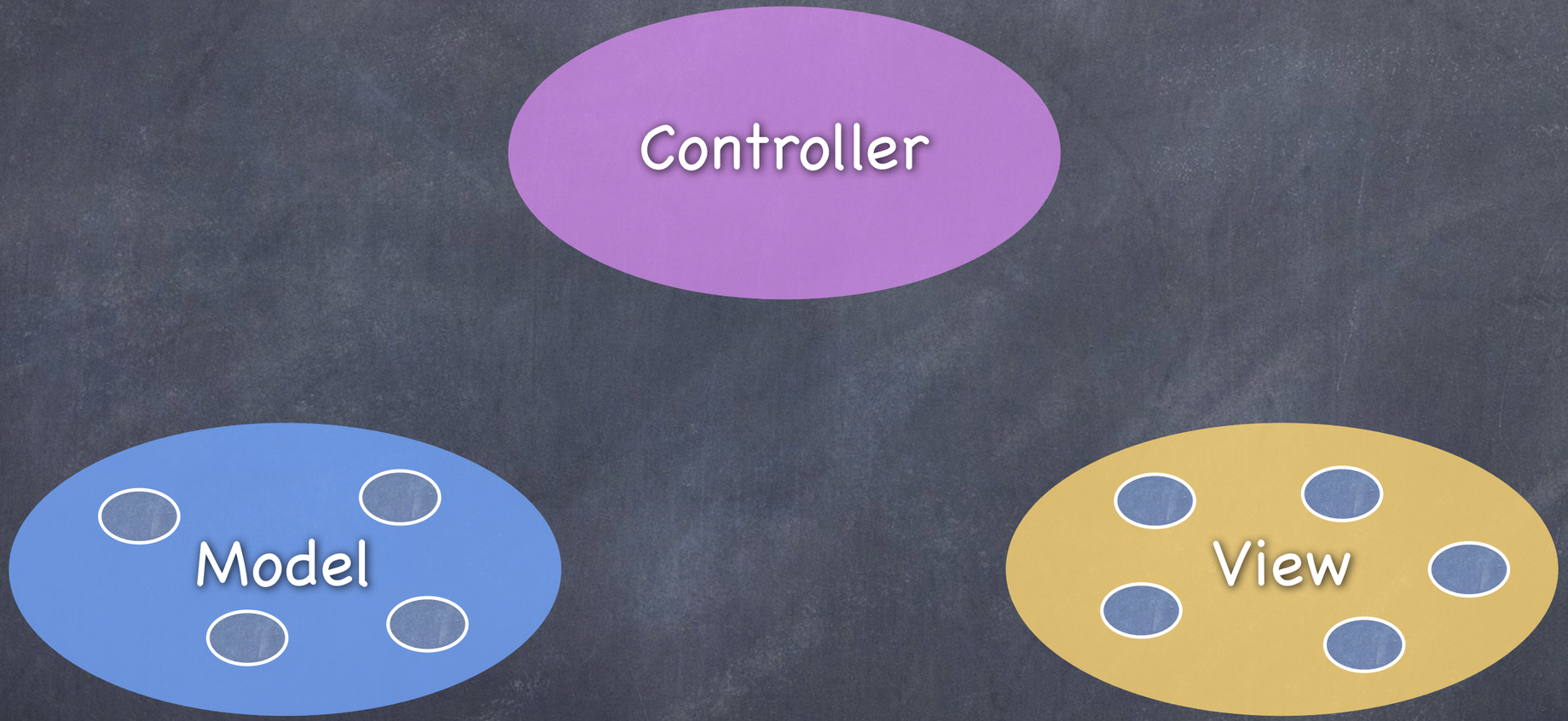
- Solution

  Manage the state (only) and declare how the UI can be built from the state

  Then let the framework generate any UI updates needed for any state changes that occur

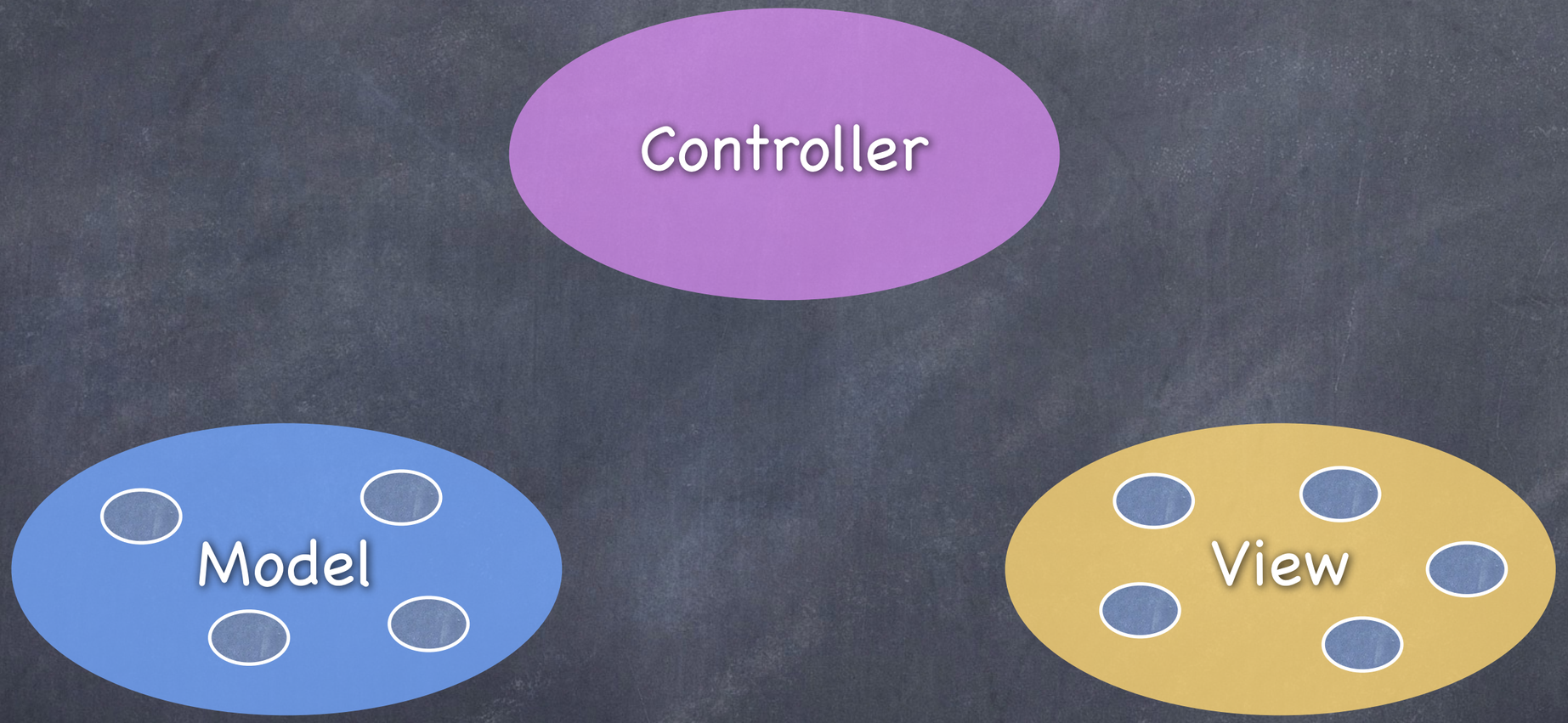
  I.e. you notify the framework of a state change and it re-renders the UI

MVC



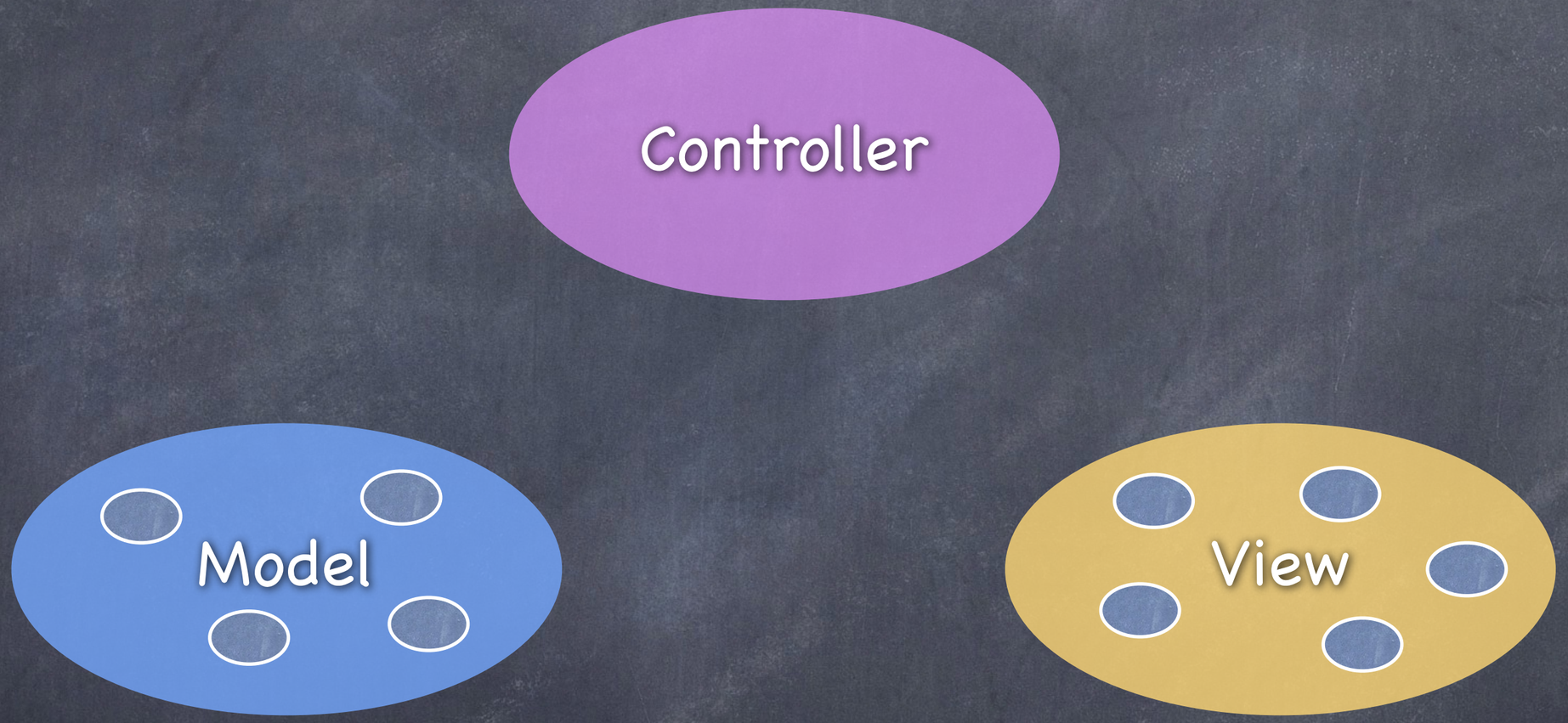
Divide objects in your program into 3 "camps"

MVC



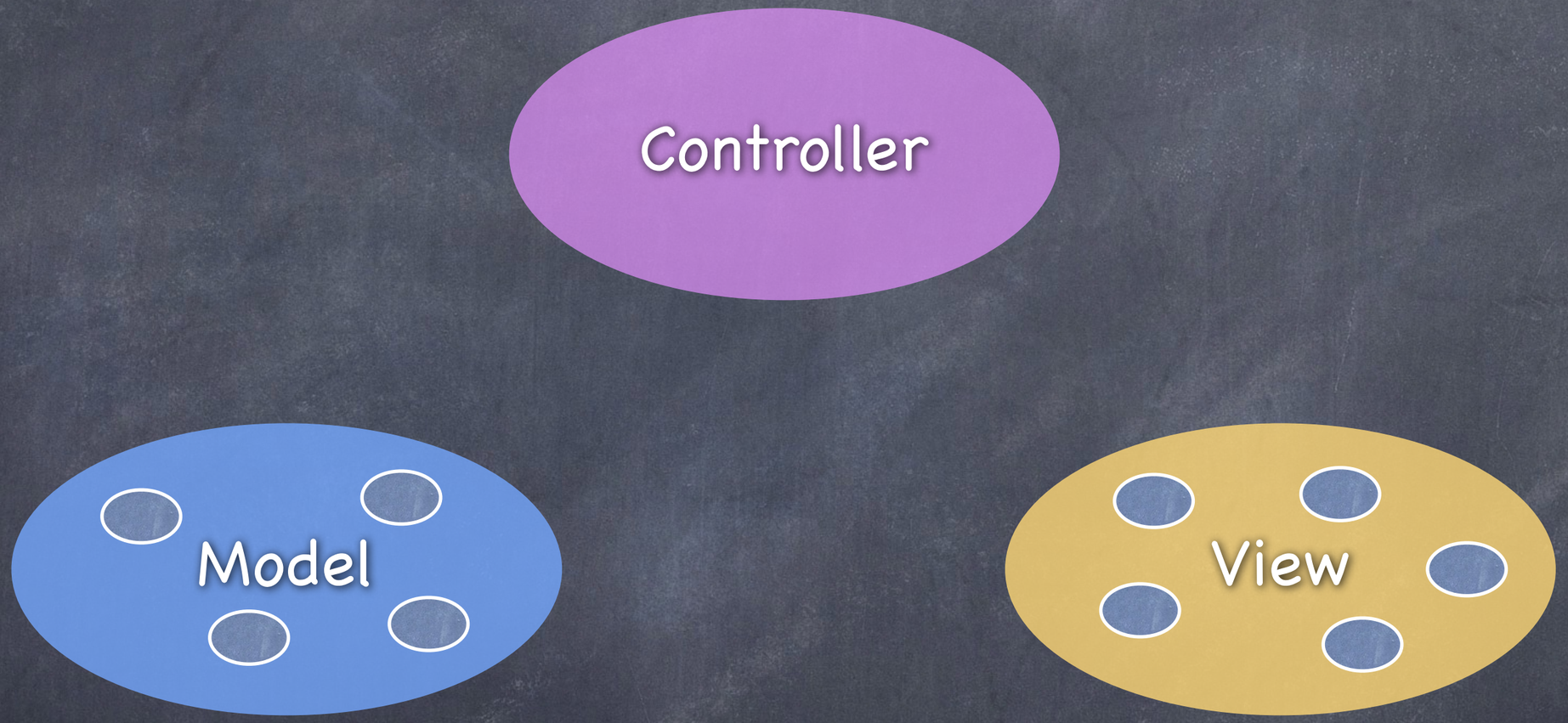
Model = <u>what</u> your application is about (but not <u>how</u> it is displayed)

MVC



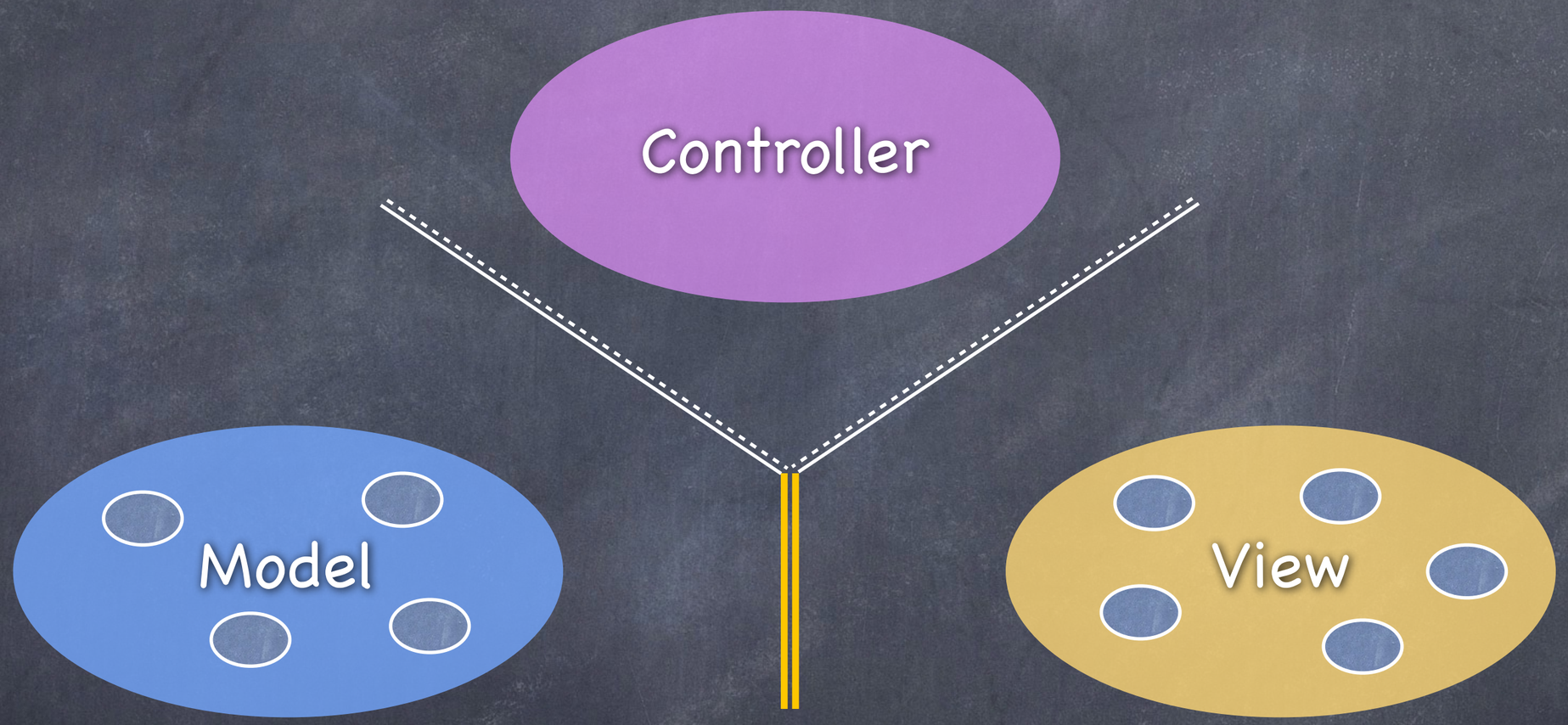
Controller = <u>how</u> your Model is presented to the user (UI logic)

MVC



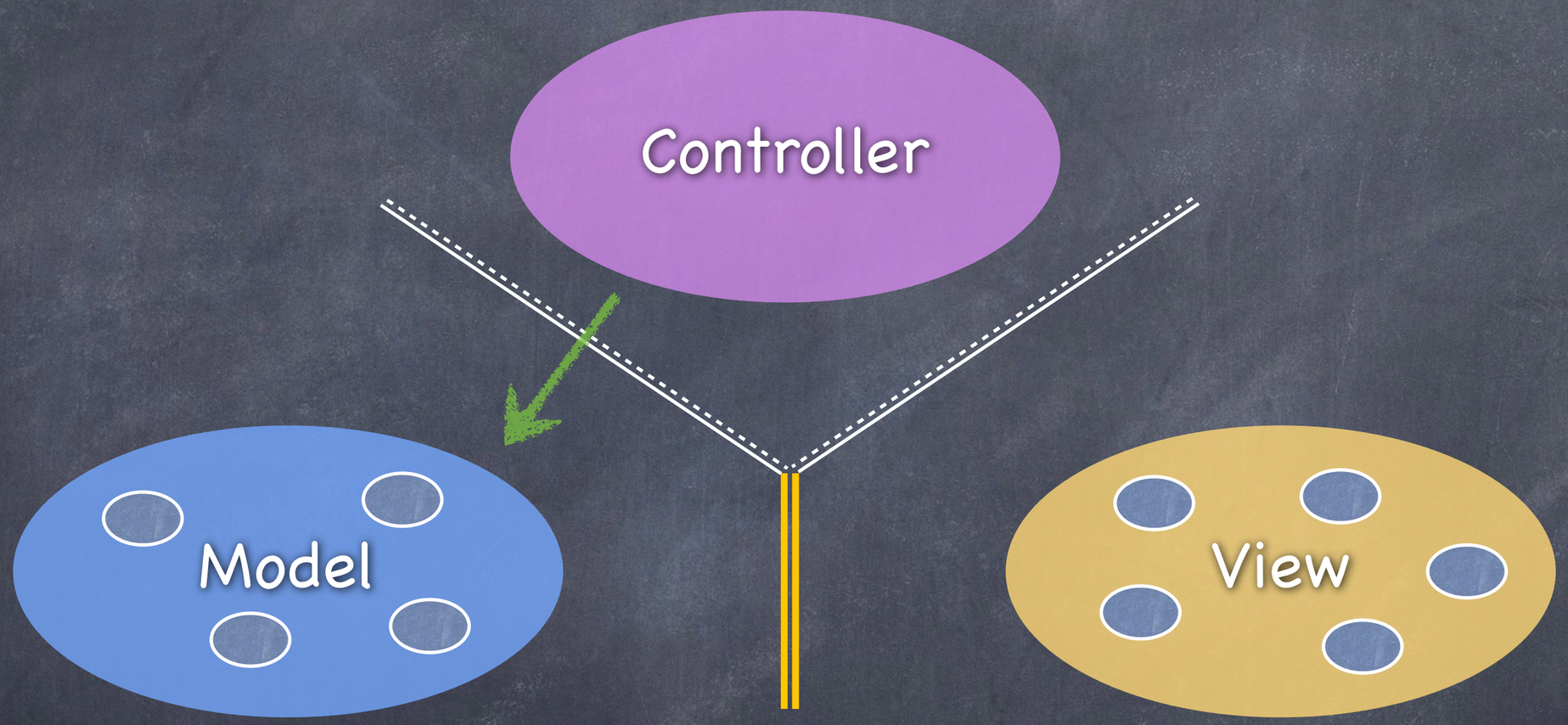
View = your Controller's minions

MVC



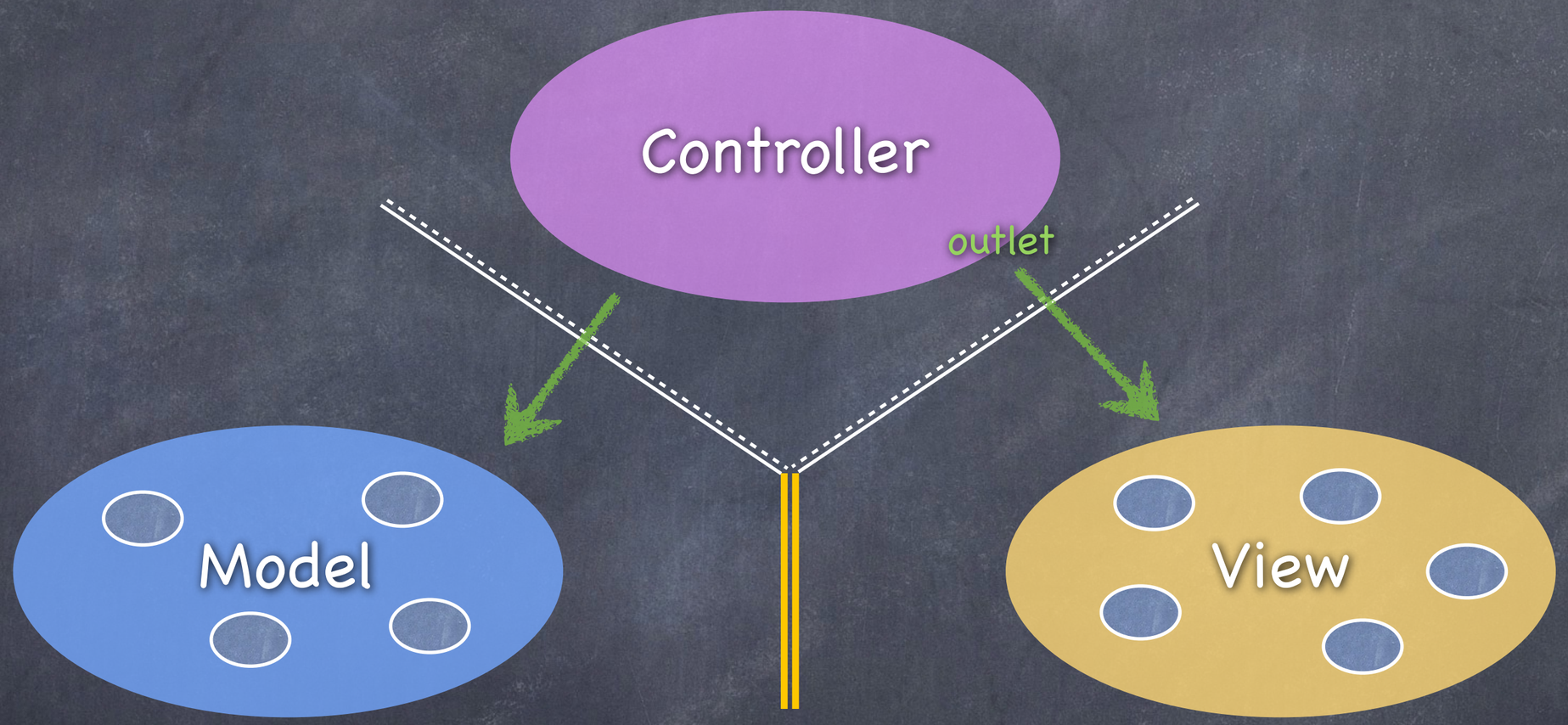
It's all about managing communication between camps

MVC



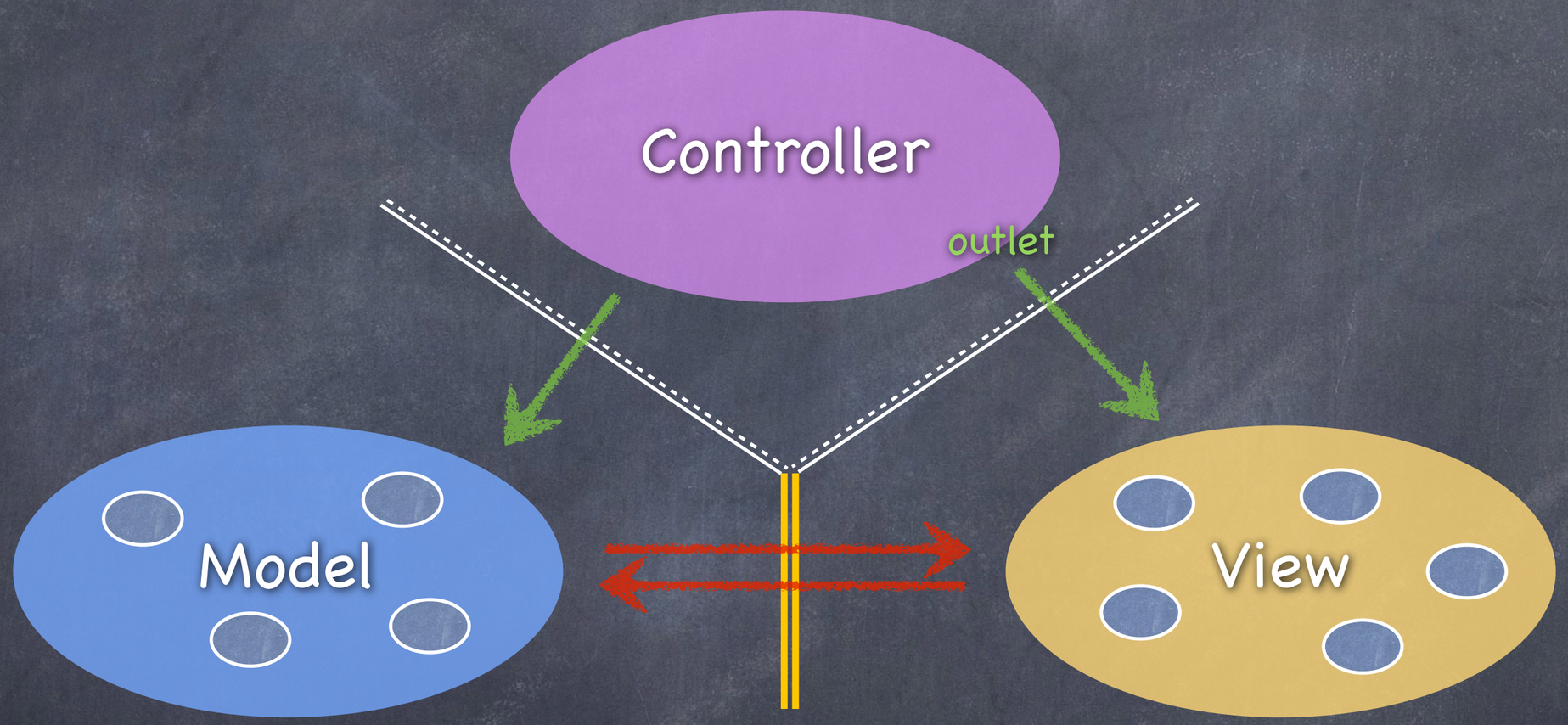
Controllers can always talk directly to their Model

MVC



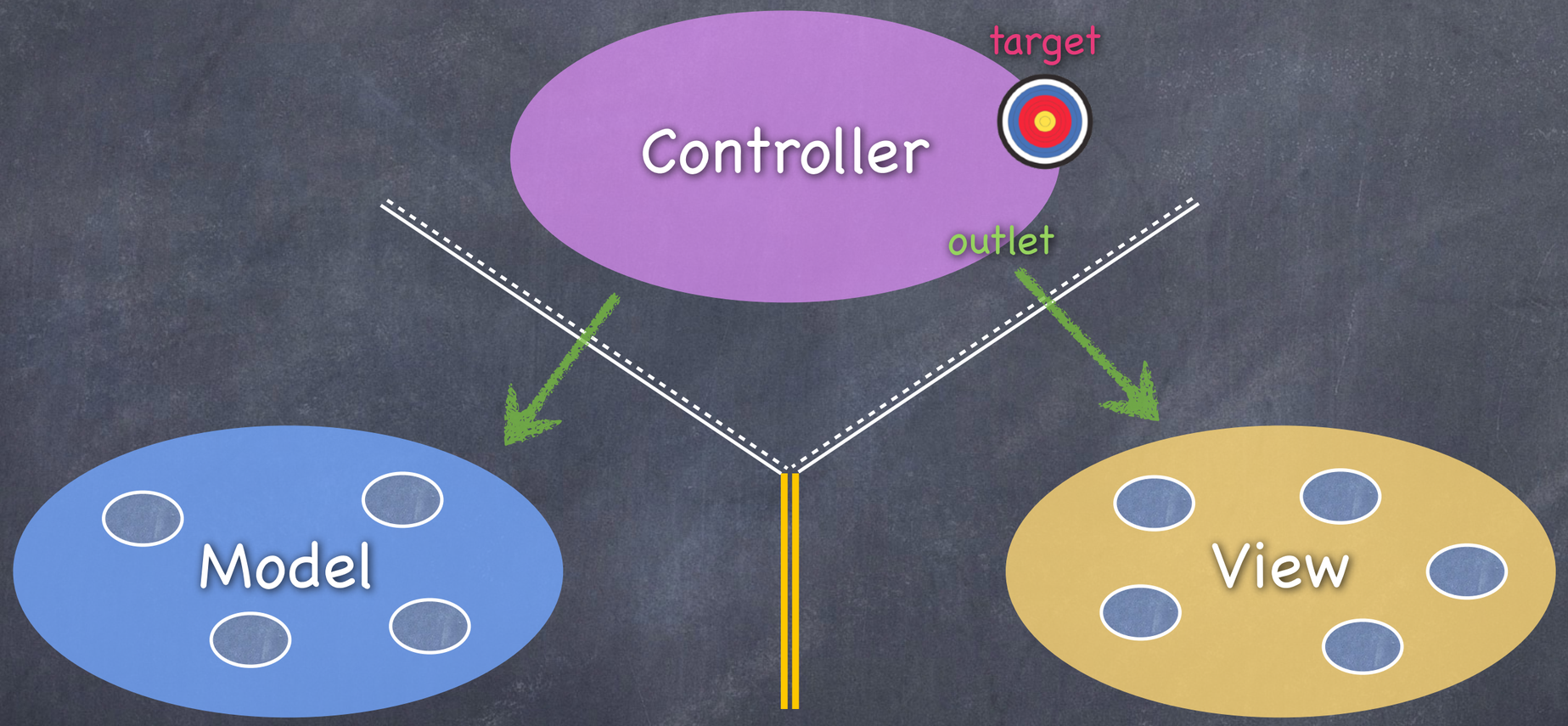
Controllers can also talk directly to their View

MVC



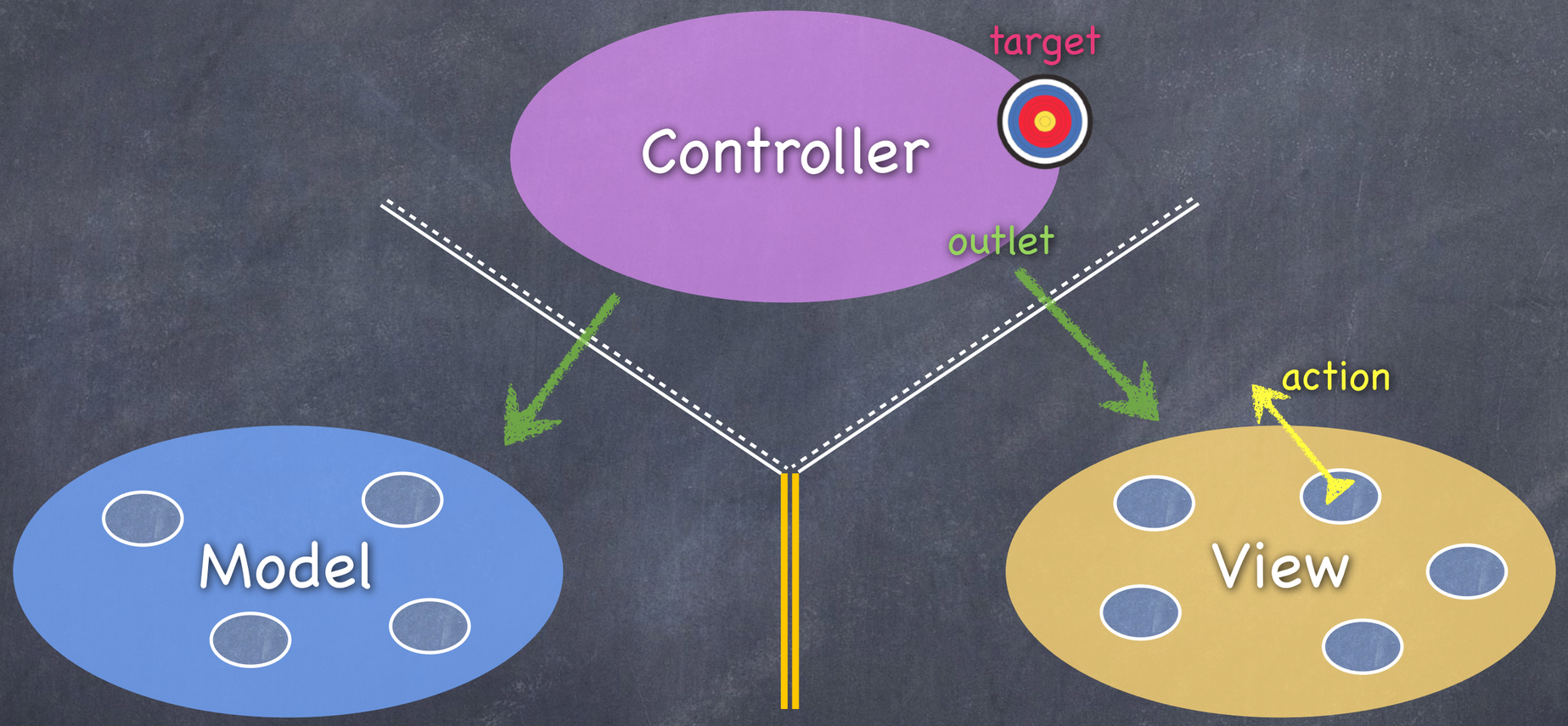
Model and View should never speak to each other

MVC



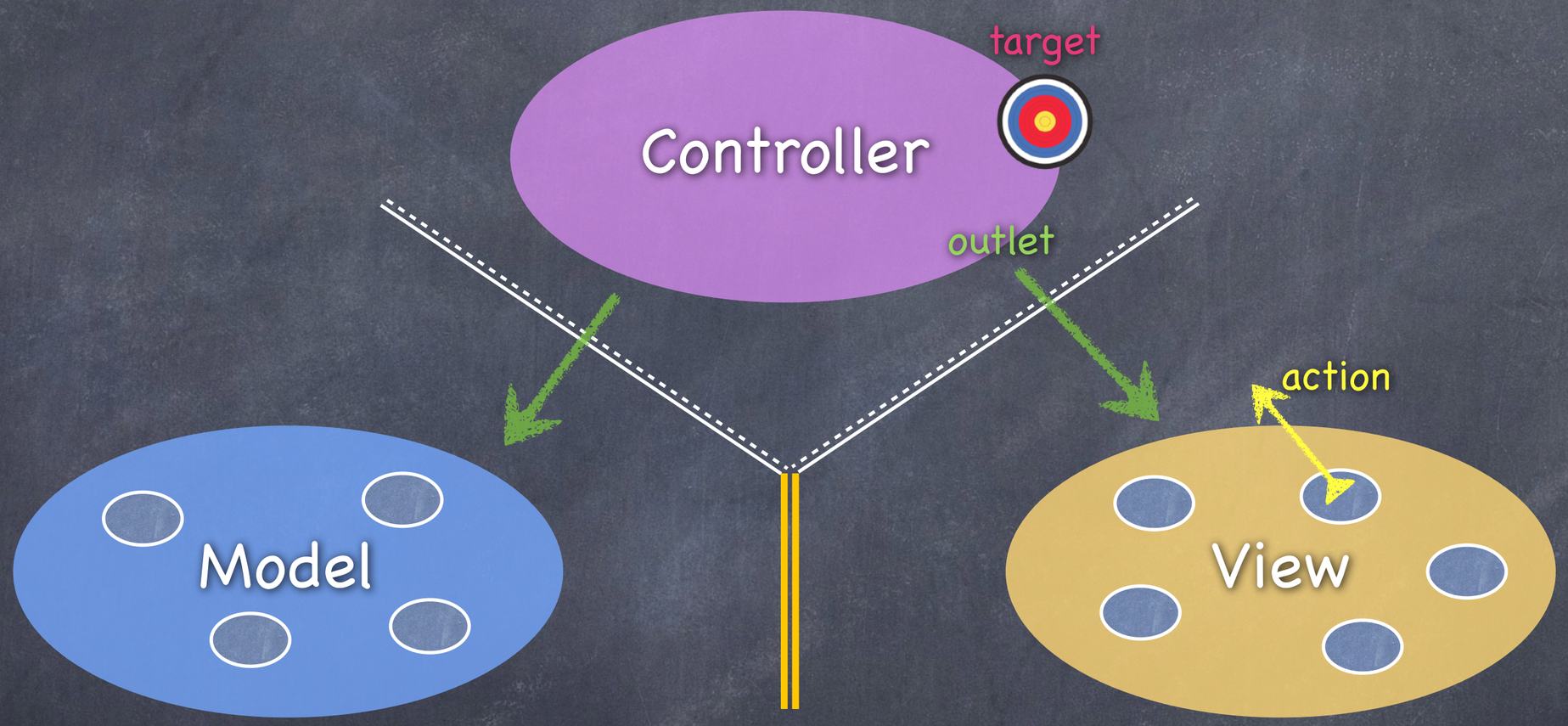
The Controller can drop a target on itself

MVC



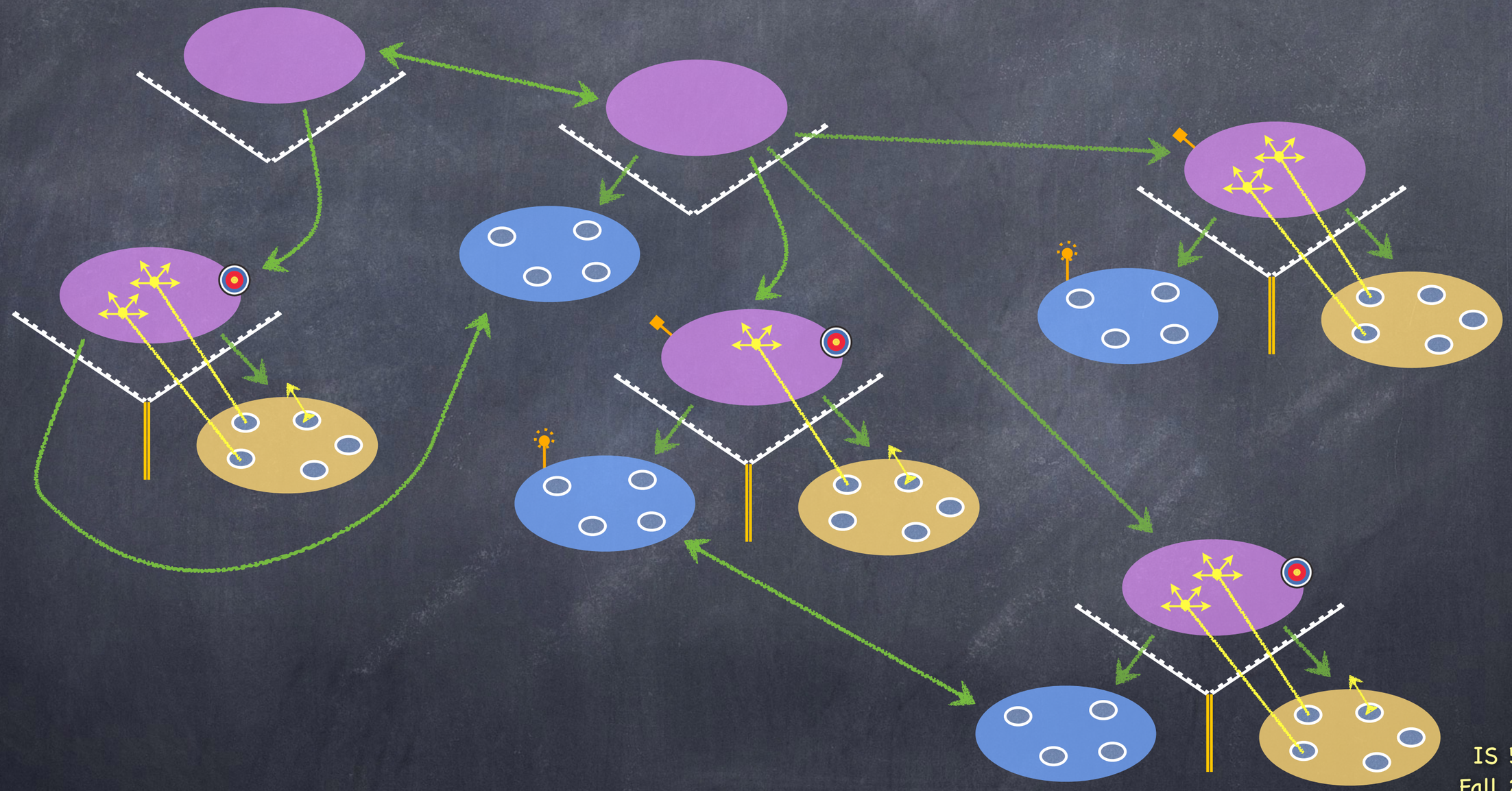
Then hand out an action to the View

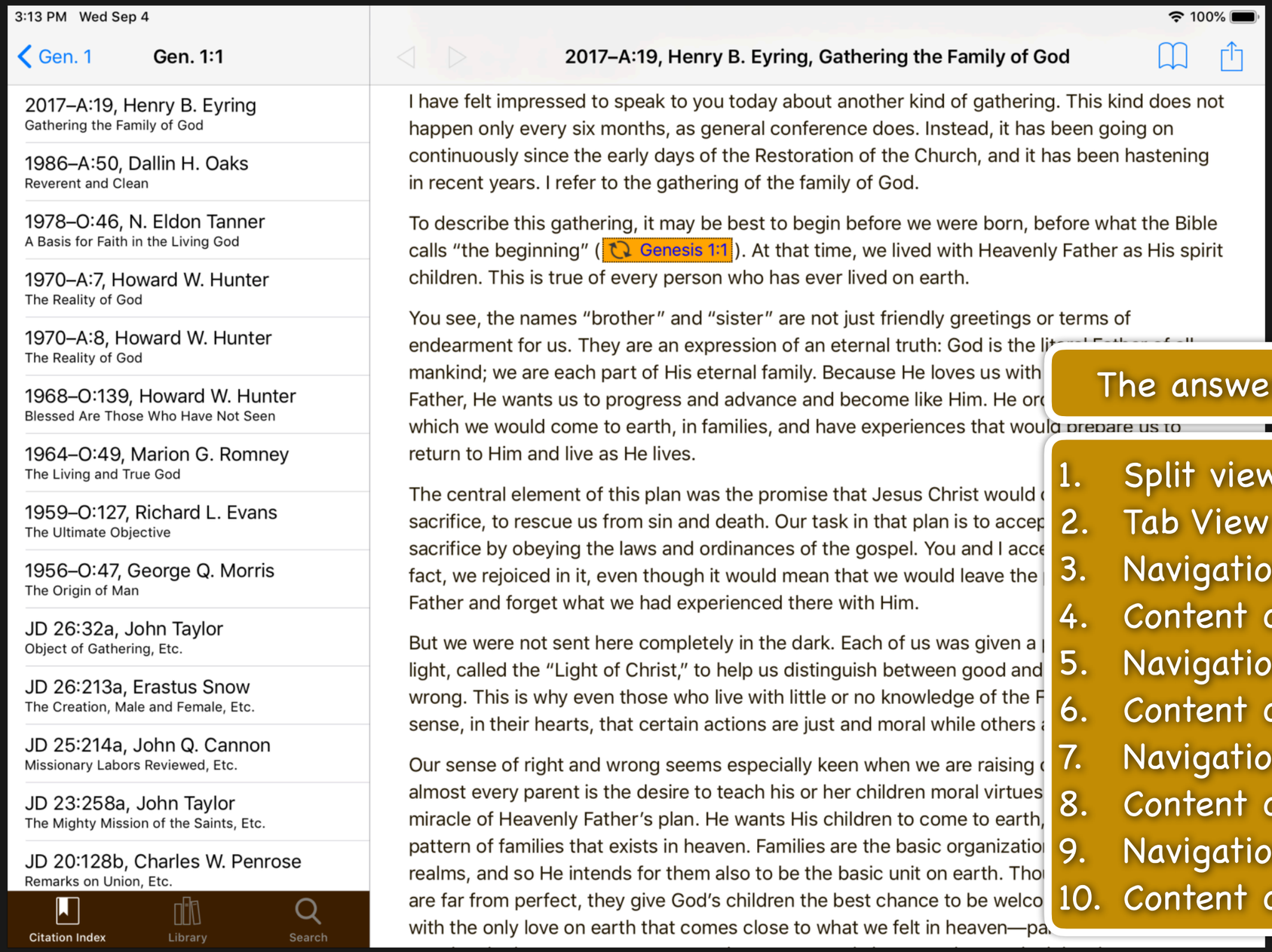
MVC



The View sends the action when things happen in the UI

MVCs Working Together





How many MVC units are there?

The answer turns out to be at least 10!

1. Split view controller
2. Tab View Controller
3. Navigation controller: Gen. 1:1
4. Content controller: Talks citing Gen. 1:1
5. Navigation controller: HBE talk
6. Content controller: HBE talk
7. Navigation controller: Library (hidden)
8. Content controller: Library (hidden)
9. Navigation controller: Search (hidden)
10. Content controller: Search (hidden)

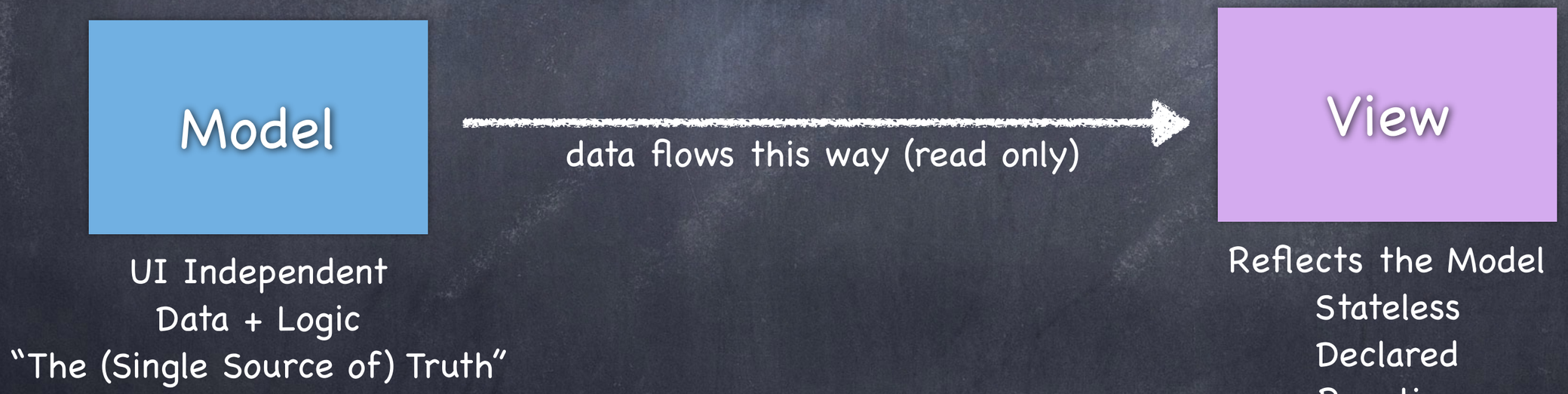
MVVM

Model

UI Independent
Data + Logic
"The (Single Source of) Truth"

View

MVVM


Model
data flows this way (read only)
View
UI Independent
Data + Logic
"The (Single Source of) Truth"
Reflects the Model
Stateless
Declared
Reactive

MVVM

```
ObservableObject
@Published
objectWillChange.send()
.environmentObject()
```

might "interpret"

ViewModel

publishes "something changed"

notices changes

Binds View to Model
Interpreter

automatically
observes publications,
pulls data,
and rebuilds

Model

UI Independent
Data + Logic
"The (Single Source of) Truth"

View

Reflects the Model
Stateless
Declared
Reactive

MVVM

ObservableObject
@Published
objectWillChange.send()
.environmentObject()

might "interpret"

publishes "something changed"

ViewModel

Binds View to Model
Interpreter

notices changes

automatically
observes publications,
pulls data,
and rebuilds

Model

UI Independent
Data + Logic
"The (Single Source of) Truth"

@ObservedObject
@Binding
.onReceive
@EnvironmentObject

View

Reflects the Model
Stateless
Declared
Reactive

MVVM

ObservableObject
@Published
objectWillChange.send()
.environmentObject()

might "interpret"

publishes "something changed"

calls "intent" function

modifies the Model

notices changes

ViewModel

Binds View to Model
Interpreter
Processes Intent

automatically observes publications, pulls data, and rebuilds

Model

UI Independent
Data + Logic
"The Truth"

@ObservedObject
@Binding
.onReceive
@EnvironmentObject

View

Reflects the Model
Stateless
Declared
Reactive

What about the other direction?

Coming Up...

- More Swift, SwiftUI, Xcode discussion & demo

Homework 2 for Tuesday

- HW 2 due BEFORE class Tue. Sep. 12
- Start playing around with Swift (in Xcode if you can, on paper otherwise)

  Write Swift functions to do the following:

  1. Compute the nth Fibonacci number (0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, ...) for integer $n \geq 0$
  2. Compute n! (factorial) for integer $n \geq 0$
  3. Compute the sum of all integers between two given integers (inclusive)
  4. Given a number of cents, print to the console the corresponding U.S. coins that total to the given number. Print the solution that needs the fewest coins. Only use pennies, nickels, dimes, and quarters. Example: for 113, the answer is "4 quarters", "1 dime", "3 pennies". Do not print the case where the solution calls for 0 of the coin (e.g. don't print "0 nickels"). Use the singular word is the value is 1, or the plural if the coin count is greater than 1.

  Create a simple SwiftUI interface to test your four functions.

  Turn in on Learning Suite by submitting a PDF document with your Swift code for these four tasks and a screenshot of your UI.
  (This will be easier for me to grade than opening up your project and looking at it.)

Additional Reading

- You need to start reading the Swift Language Guide too
  I've given enough homework for Tuesday, so I won't measure your reading by giving homework points for it
- Suggested sections of the Swift Language Guide to study with HW 2:
  The Basics
  Strings and Characters
  Collection Types
  Control Flow
  Functions