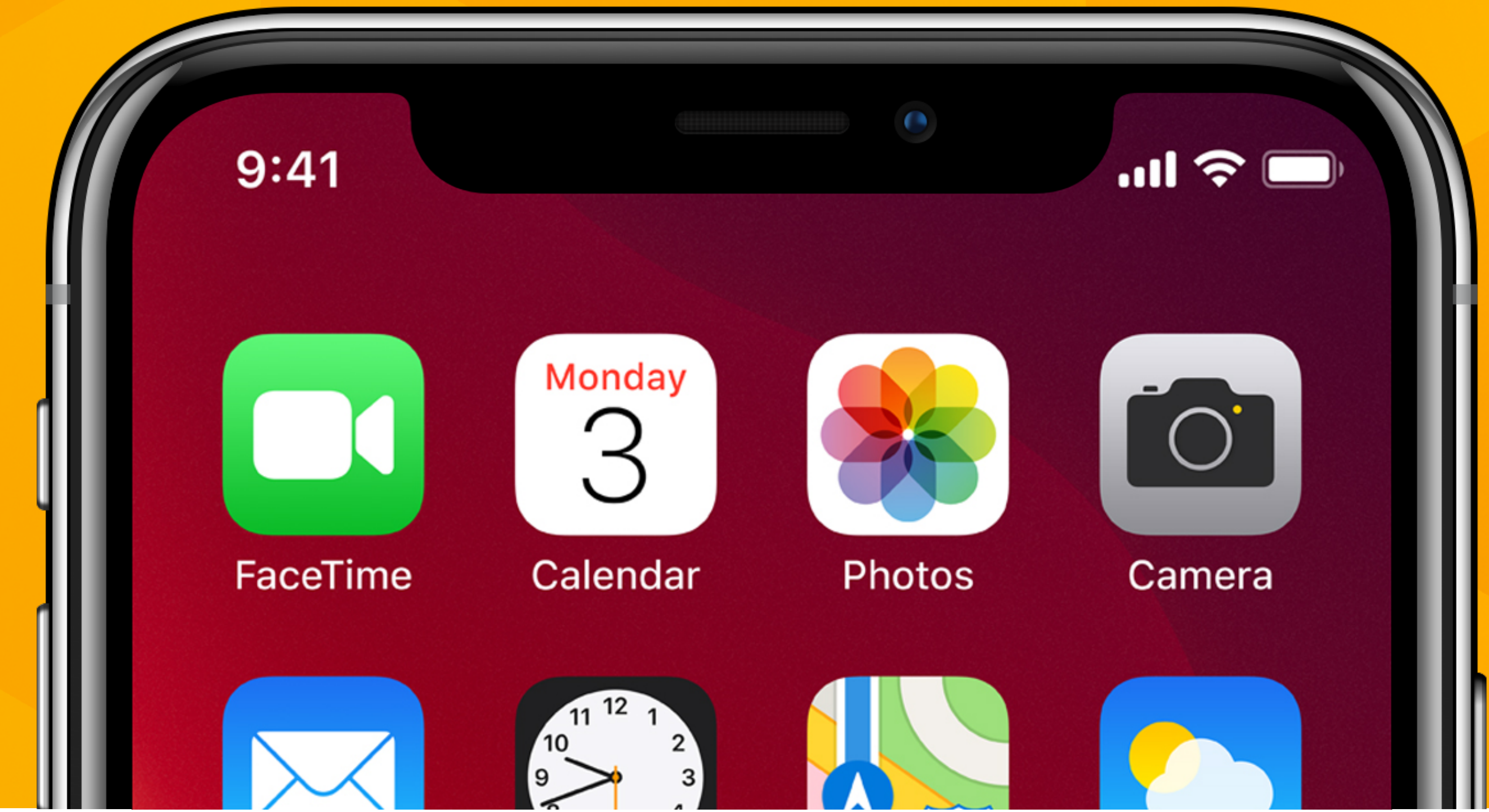

iOS Application Development

Lecture 5: Auto Layout, Protocols, and Extensions

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Media Computing Group
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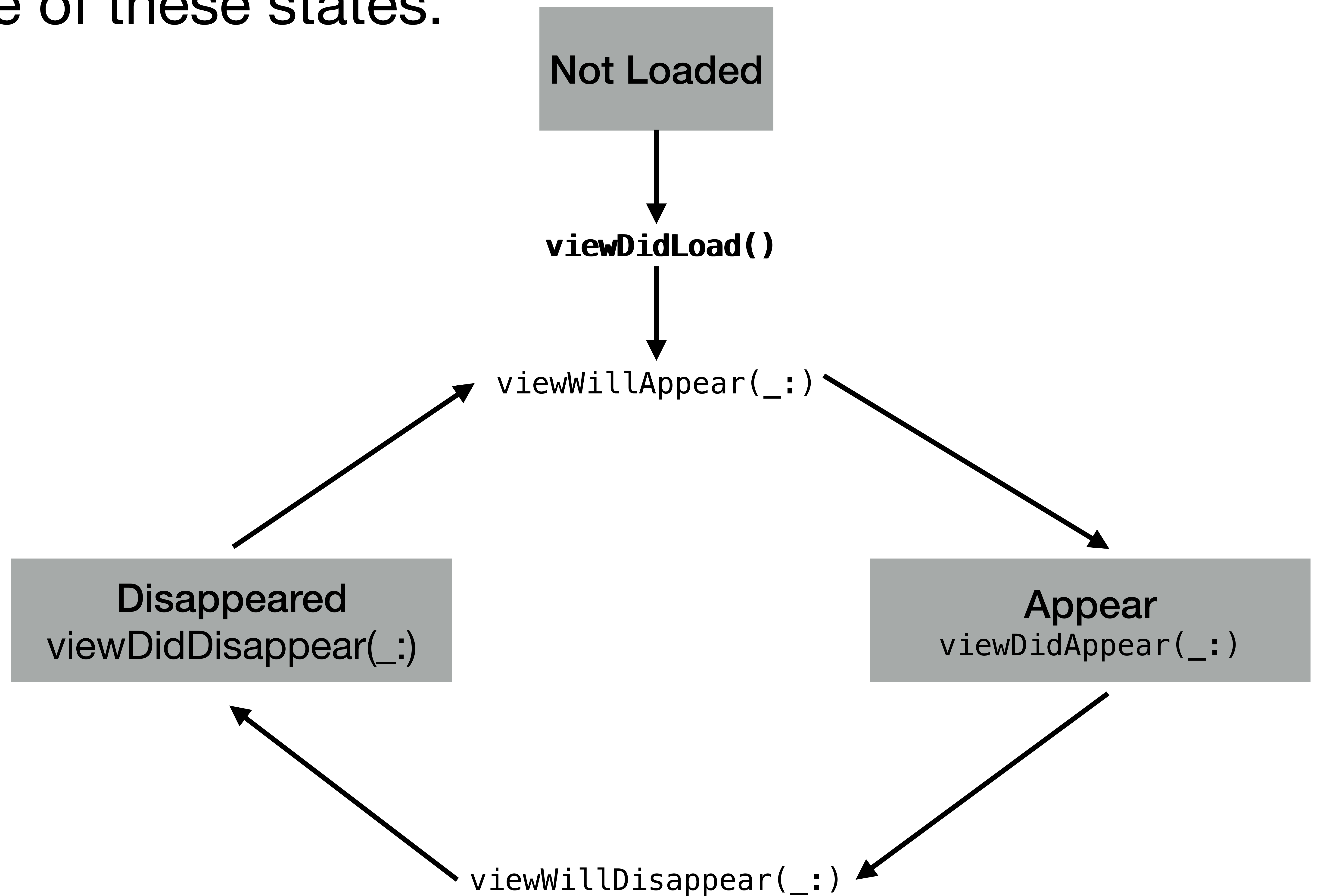
Recap

- Optionals (Int?)
- Type casting & inspection (as?)
- `Guard`
- Enumeration
- Segues
- Navigation Controller

View Controllers

View Controller Life-Cycle

- View Controllers can be in one of these states:
  - View not loaded
  - View appearing
  - View appeared
  - View disappearing
  - View disappeared



Application Life Cycle

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iPhone 13

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iOS Application Development (2021/22)

Class Information

Lectures	Mon, 12:30 - 14:00 (starting 18.10.2021) Tue, 10:30 - 12:00 (starting 12.10.2021) Online Zoom lectures
Language	English
Credits	6

Exams

AppDelegate.swift

SceneDelegate.swift

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AppDelegate.swift

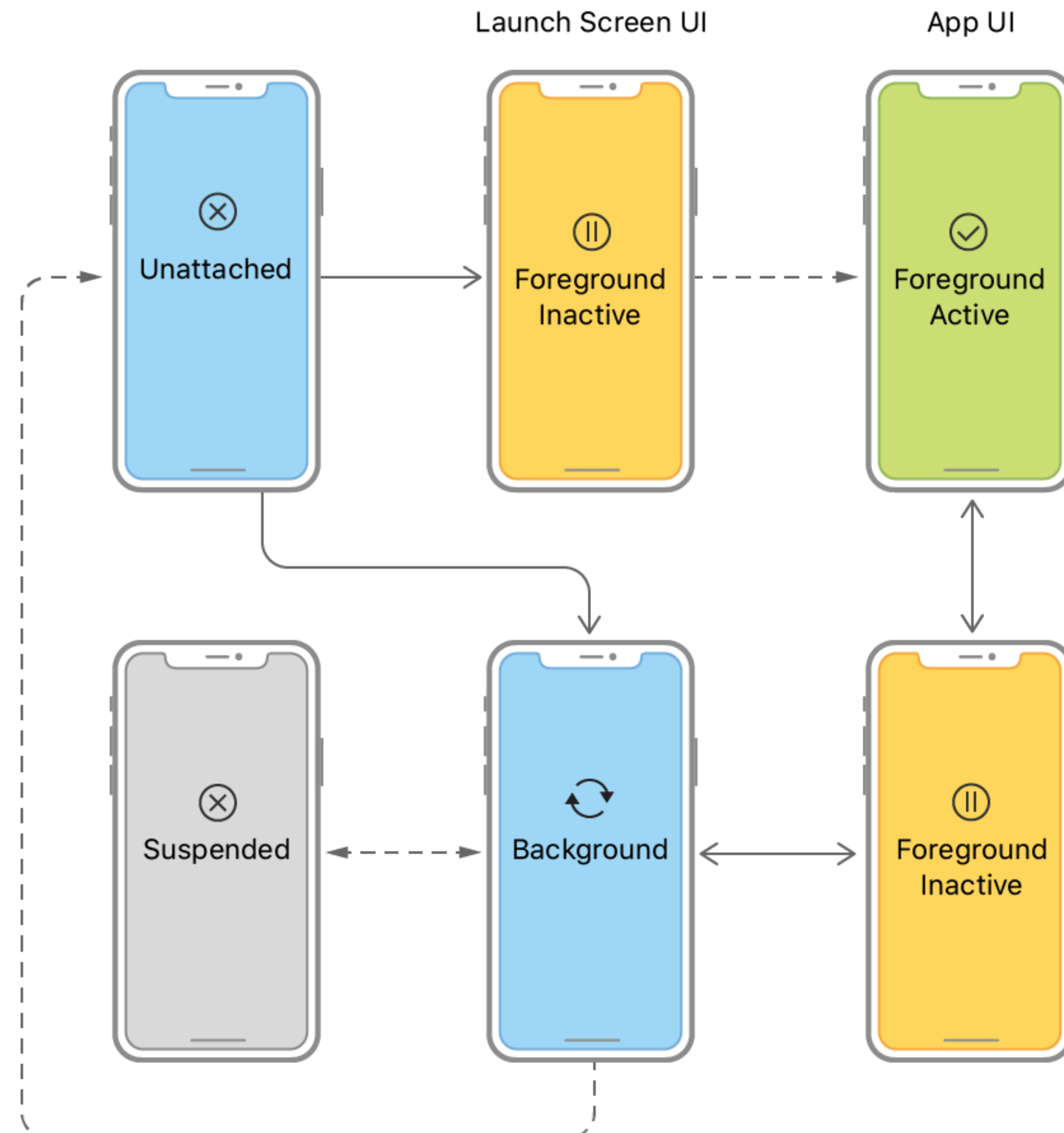
```
func application(_ application: UIApplication, didFinishLaunchingWithOptions
launchOptions: [UIApplication.LaunchOptionsKey: Any]?) -> Bool {
              return true
    }

func application(_ application: UIApplication, configurationForConnecting
connectingSceneSession: UISceneSession, options: UIScene.ConnectionOptions) ->
UISceneConfiguration {
    }

func application(_ application: UIApplication, didDiscardSceneSessions sceneSessions:
Set<UISceneSession>) {
    }
```

Source: https://developer.apple.com/documentation/uikit/app_and_environment/managing_your_app_s_life_cycle

Scene Life Cycle



SceneDelegate.swift

```
func scene(_ scene: UIScene, willConnectTo session: UISceneSession, options
connectionOptions: UIScene.ConnectionOptions) {
    }

func sceneDidDisconnect(_ scene: UIScene) {
    }

func sceneDidBecomeActive(_ scene: UIScene) {
    }

func sceneWillResignActive(_ scene: UIScene) {
    }

func sceneWillEnterForeground(_ scene: UIScene) {
    }

func sceneDidEnterBackground(_ scene: UIScene) {
    }
```

Auto Layout Demo

4 Pieces of Information

- We need 4 pieces of information for Auto Layout to position a view
  - *X* position
  - *Y* position
  - *Width*
  - *Height*

Safe Area

- This is a space on the screen which usually should not contain views
- It is automatically included when adding a view controller in the storyboard
- Constraints will, by default, chose the boundaries of the *safe area* instead of the whole device

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Constraints

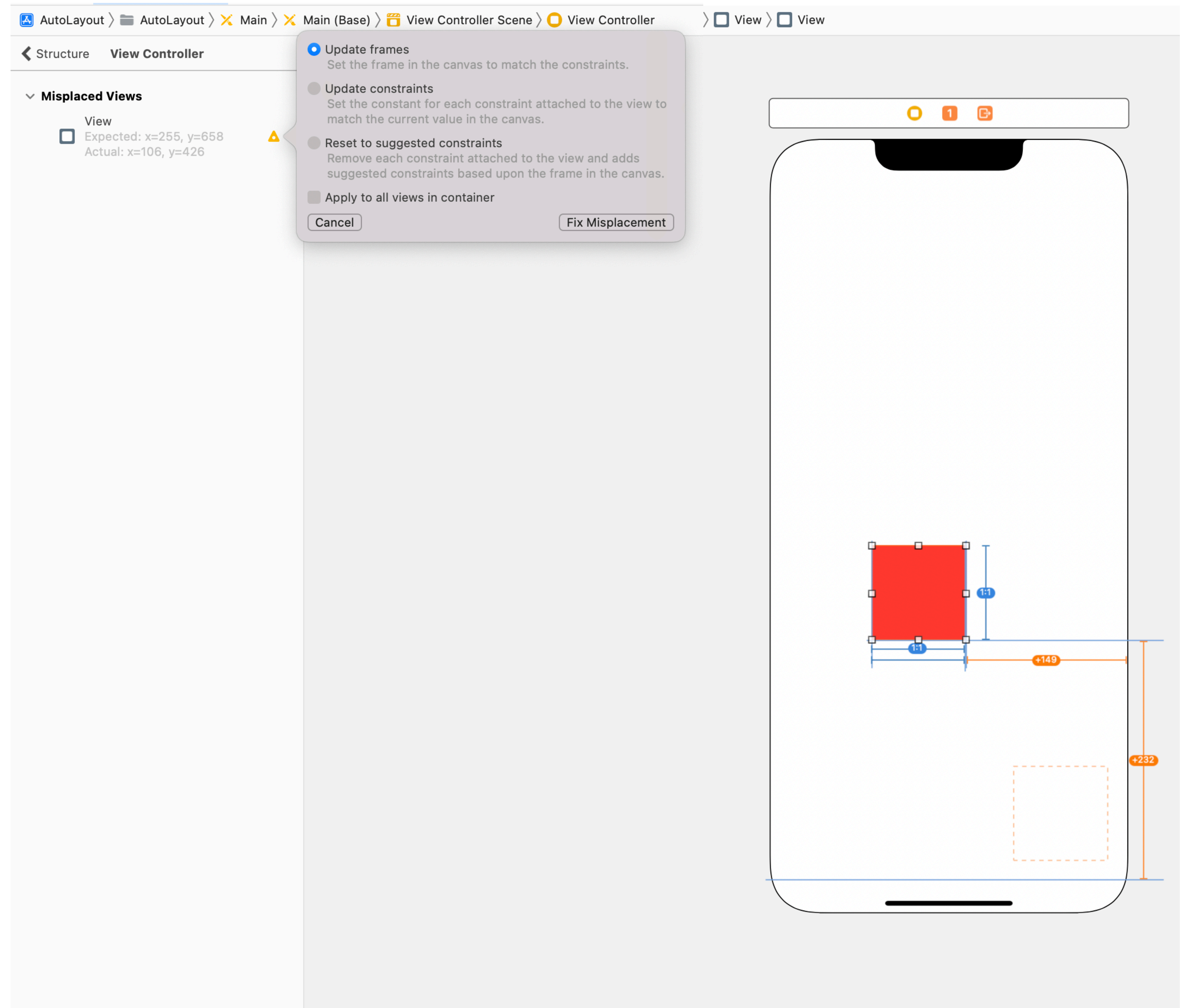
- Constraints are rules by which the views are aligned using Auto Layout
- Examples for such constraints are:
  - Centring a view
  - Aligning a view relative to a margin or another view
  - Setting the size of a view relative to another view

Leading and Trailing

- *Leading* and *trailing* constraints are used to specify constraints to the right and left side of a view
    - To support different language directions, we usually don't use *left* and *right* constraints
- *Leading* constraints deal with the starting edge of a view in language direction
- *Trailing* constraints deal with the ending edge of a view in language direction

Misplacement

- If the visual representation does not match the correct layout, Auto Layout provides a warning
- Auto Layout can fix the misplacement



Intrinsic Size

- Some views already know their size e.g., labels and switches
- Such views only need information on their position for Auto Layout to handle them correctly

Hugging and Compressing

- Content Hugging Priority
  - The view does not want to grow (it hugs its content)
- Content Compression Resistance Priority
  - The view does not want to shrink
- Equal priorities might cause layout ambiguities for Auto Layout
- The view with the lower priority has to adapt to fulfil the constraints

Variants

- Variants allow us to define attributes based on the class of the used device
  - E.g., different font sizes or whether the view is visible at all
- We differentiate between the following sizes
  - *Compact* (e.g., smaller side of an iPhone)
  - *Regular* (e.g., width and height of an iPad)
  - *Any* (matches *Compact* and *Regular*)

Protocols

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Protocols

- A protocol defines a blueprint of methods, properties and other requirements
- If your type adopts a protocol, you promise to implement these requirements
- Swift utilizes many protocols such as:
  - `CustomStringConvertible`
  - `Equatable`
  - `Comparable`

Sample Protocol: CustomStringConvertible

```swift
let string = "Hello, world!"
print(string) // Output: Hello, world!

let number = 42
print(number) // Output: 42

let boolean = false
print(boolean) // Output: false
```


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Sample Protocol: CustomStringConvertible

```
class Shoe {
     let color: String
     let size: Int
     let hasLaces: Bool

     init(color: String, size: Int,
          hasLaces: Bool) {
        self.color = color
        self.size = size
        self.hasLaces = hasLaces
     }
}
```

```
let myShoe = Shoe(color: "Black", size: 12,
hasLaces: true)
let yourShoe = Shoe(color: "Red", size: 8,
hasLaces: false)


print(myShoe)
// Output: __lldb_expr_143.Shoe
print(yourShoe)
// Output: __lldb_expr_143.Shoe
```


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Sample Protocol: CustomStringConvertible

```
class Shoe : CustomStringConvertible {
      let color: String
      let size: Int
      let hasLaces: Bool

      init(color: String, size: Int,
           hasLaces: Bool) {
          self.color = color
          self.size = size
          self.hasLaces = hasLaces
      }
      var description: String {
         return "\(color) shoe in size
           \(size), hasLaces: \(hasLaces)"
      }
}
```

```
let myShoe = Shoe(color: "Black", size: 12,
hasLaces: true)
let yourShoe = Shoe(color: "Red", size: 8,
hasLaces: false)


print(myShoe)
// Output:
Black shoe in size 12, hasLaces: true
print(yourShoe)
// Output:
Red shoe in size 8, hasLaces: false
```

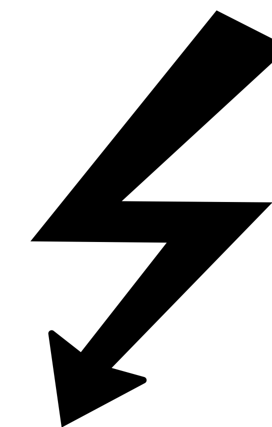
Sample Protocol: Equatable

```
struct Employee {
     var firstName: String
     var lastName: String
     var jobTitle: String
     var phoneNumber: String
}
```

```
let employeeA = Employee(...)

let employeeB = Employee(...)

if employeeB == employeeA {  // Do Something
}
else {                       // Do Something else
}
```



```
error: binary operator
'==' cannot be applied to
two 'Employee' operands
```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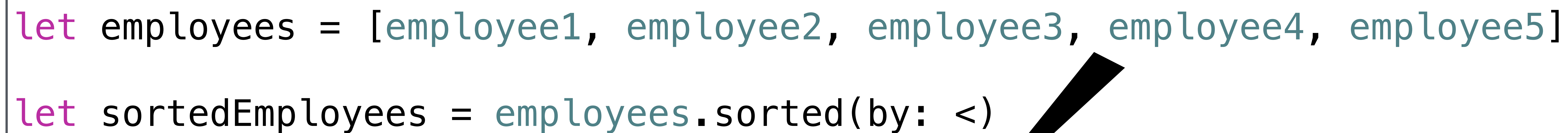
Sample Protocol: Equatable

```
struct Employee : Equatable {
     var firstName: String
     var lastName: String
     var jobTitle: String
     var phoneNumber: String

     static func == (lhs: Employee, rhs: Employee) -> Bool {
        return  lhs.firstName == rhs.firstName &&  lhs.lastName == rhs.lastName
     }
}
```

```
let employeeA = Employee(...)

let employeeB = Employee(...)

if employeeB == employeeA {  // Do Something
}
else {                       // Do Something else
}
```

Sample Protocol: Comparable

```swift
struct Employee : Equatable {
     var firstName: String
     var lastName: String
     var jobTitle: String
     var phoneNumber: String

     static func == (lhs: Employee, rhs: Employee) -> Bool {
        return   lhs.firstName == rhs.firstName &&  lhs.lastName == rhs.lastName
     }
}
```



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Sample Protocol: Comparable

```
struct Employee : Equatable, Comparable {
     var firstName: String
     var lastName: String
     var jobTitle: String
     var phoneNumber: String

     static func == (lhs: Employee, rhs: Employee) -> Bool {
        return  lhs.firstName == rhs.firstName &&  lhs.lastName == rhs.lastName
     }
     static func < (lhs: Employee, rhs: Employee) -> Bool {
        return lhs.lastName < rhs.lastName
     }
}
```

```
let employees = [employee1, employee2, employee3, employee4, employee5]

let sortedEmployees = employees.sorted(by: <)
```


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Creating a Protocol

```
protocol FullyNamed {
    var fullName: String { get }

    func sayFullName()
}
```


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Creating a Protocol

```
protocol FullyNamed {
    var fullName: String { get }

    func sayFullName()
}

struct Person: FullyNamed {
    var firstName: String
    var lastName: String

    var fullName: String {
        return "\(firstName) \(lastName)"
    }

    func sayFullName() {
        print(fullName)
    }
}
```


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Delegation

- Delegation is a **design pattern** to hand off (delegate) responsibilities to an instance of another type
- UIKit and other iOS frameworks use it extensively
- TableView example:

```
class MyViewController:  UITableViewDataSource, UITableViewDelegate {
…
myTableView.dataSource = self
myTableView.delegate = self
}
```


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Extensions

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Extensions

- Extensions add functionality to types that are already defined.
- You can:
    - add **computed** properties
    - define methods
    - provide new initializers
    - conform an existing type to a protocol
- You cannot add properties!

```
extension SomeType {
    // new functionality to add to
    // SomeType goes here
}

extension UIColor {
    static var favoriteColor: UIColor {
       return UIColor( red: 0.5,
                       green: 0.1,
                       blue: 0.5,
                       alpha: 1.0)
    }
}
```

Extensions

```
struct Employee : Equatable {
     var firstName: String
     var lastName: String
     var jobTitle: String
     var phoneNumber: String

     static func == (lhs: Employee, rhs: Employee) -> Bool {
        return  lhs.firstName == rhs.firstName &&  lhs.lastName == rhs.lastName
     }
}
```

```
struct Employee {
     var firstName: String
     var lastName: String
     var jobTitle: String
     var phoneNumber: String
}
extension Employee : Equatable {
     static func == (lhs: Employee, rhs: Employee) -> Bool {
        return  lhs.firstName == rhs.firstName &&  lhs.lastName == rhs.lastName
     }
}
```

Summary

- App and ViewController Lifecycle
- AutoLayout
- Protocols
- Extensions
- No classes next Monday & Tuesday—catch up on reading
- Next lecture
    - ScrollViews and TableViews