

# Enemy of the State

**Presentation available at  
[github.com/jspahrsummers/enemy-of-the-state](https://github.com/jspahrsummers/enemy-of-the-state)**



**Programming is all about  
abstraction**

**We want to be using the  
best possible  
abstractions for development**

what even is  
state?

# **State**

**Your stored values at any given time**

# **Mutation**

**The act of updating some state in place**

# Variables are state

```
var x: Int
```

```
// Store a value into the variable
```

```
a = 5
```

```
// Update (mutate) the variable, by replacing the value
```

```
a = 2
```

```
// Mutate the variable again
```

```
a++
```

State is  
easy

**Easy  
and  
Simple  
are not the same**

*See Rich Hickey's talk, "Simple Made Easy"*

**easy**

*Familiar or approachable*

# simple

**Fewer concepts and concerns**



0 0 0 0 0 0 0 F

0 0 0 0 0 0 0 3

# **complexity**

**Mixing (“complecting”) concepts or concerns**

**State is  
familiar  
(but complex)**

**All systems have  
*essential* complexity**

**State also adds  
*incidental* complexity**

*See Moseley and Marks' paper, "Out of the Tar Pit"*

var visible → 2 states

var enabled → 4 states

var selected → 8 states!

var highlighted → 16 states!!

**State is just a  
glorified cache**

*There are only two hard problems in Computer Science: **cache invalidation** and naming things.*

**– Phil Karlton**

# Table views as a cache

```
@IBAction func addBlankRow(sender: AnyObject!) {  
    self.items.append("")  
  
    let indexPath = NSIndexPath(forRow: self.items.count,  
                               inSection: 0)  
  
    self.tableView.insertRowsAtIndexPaths([ indexPath ],  
                                         withRowAnimation: UITableViewRowAnimation.Automatic)  
}
```

*See Andy Matuschak's post, "Mutability, aliasing, and the caches you didn't know you had"*

**State is  
unpredictable**

A dynamic photograph capturing a cheetah in mid-stride, chasing a gazelle across a grassy plain. The cheetah's body is angled towards the right, its long legs extended. The gazelle is also running to the right, slightly behind the cheetah. The background is a soft-focus view of a hilly landscape under a clear sky.

race conditions

[State is] *spooky action at a distance*

– **Albert Einstein** (probably)

# State is unpredictable

```
let x = self.myInt  
println(x)
```

**==> 5**

```
let y = self.myInt  
println(y)
```

**==> 10 (?!?!)**

State is  
hard to test

# Tests

**verify expected outputs for certain inputs**

# State

**is an *implicit* input that can change**



**State! State! State! State!**

# Hey, state happens

- Preferences
- Open documents
- Documents saved to disk
- In-memory or on-disk caches
- UI appearance and content

**Minimize state  
Minimize complexity**

**Values  
Purity  
Isolation**

**values**

**Purity**

**Isolation**

**structs**

**enums**

**copied**  
**(not shared)**

**Value types are  
immutable  
in Swift**

But I can set the  
properties of a struct in  
Swift! This guy doesn't  
know what he's talking  
about.

**- You, the audience**

# “Mutating” a struct in Swift

```
struct Point {  
    var x = 0.0  
    var y = 0.0  
  
    mutating func scale(factor: Double) {  
        self.x *= factor  
        self.y *= factor  
    }  
}
```

# “Mutating” a struct in Swift

```
var p = Point(x: 5, y: 10)
```

# “Mutating” a struct in Swift

```
var p = Point(x: 5, y: 10)  
p.x = 7           // p = (7, 10)  
p.scale(2)       // p = (14, 20)
```

# “Mutating” a struct in Swift

```
var p = Point(x: 5, y: 10)  
let q = p
```

# “Mutating” a struct in Swift

```
var p = Point(x: 5, y: 10)  
let q = p
```

```
p.scale(2) // p = (10, 20)  
// q = (5, 10)
```

**Here's the key:**

**variables mutate  
values never change**

# “Mutating” a struct in Swift

```
var p = Point(x: 5, y: 10)  
let q = p
```

```
p.scale(2) // p = (10, 20)  
           // q = (5, 10)
```

```
q.x = 2  
q.scale(2) // Error!
```

# “Mutating” functions

```
func pointByScaling(factor: Double) -> Point {  
    return Point(self.x * factor, self.y * factor)  
}
```

```
mutating func scale(factor: Double) {  
    self.x *= factor  
    self.y *= factor  
}
```

# “Mutating” functions

```
func pointByScaling(self: Point, factor: Double) -> Point {  
    return Point(self.x * factor, self.y * factor)  
}
```

```
mutating func scale(self: Point, factor: Double) {  
    self.x *= factor  
    self.y *= factor  
}
```

# “Mutating” functions

```
func pointByScaling(self: Point, factor: Double) -> Point {  
    return Point(self.x * factor, self.y * factor)  
}
```

```
mutating func scale(inout self: Point, factor: Double) {  
    self.x *= factor  
    self.y *= factor  
}
```

**variables mutate  
values never change**

so what?

values are automatically  
thread-safe

**Values are automatically  
predictable**

# Values are predictable

```
let value = self.myData
```

```
let x = value.someInt  
println(x)
```

**==> 5**

```
let y = value.someInt  
println(y)
```

**==> still 5!**

**Values**

**Purity**

**Isolation**

# Pure functions

Same inputs always yield the same result

Must not have *observable* side effects

```
// Pure: concatenates two input strings and  
// returns the result.  
func +(lhs: String, rhs: String) -> String
```

```
protocol GeneratorType {  
    // Impure: advances to the next element  
    // and returns it.  
    mutating func next() -> Element?  
}
```

```
struct Array {  
    // Pure(?)  
    var count: Int { get }  
}
```

**Impure functions are  
surprising**

*Insanity is doing the same  
thing over and over again  
but expecting **different**  
**results.***

Pure functions are  
easily tested

**Values**

**Purity**

**Isolation**

Objects should have  
only one  
reason to change

**Isolate  
unrelated  
pieces of state**

# Isolation Done Wrong™

```
class MyViewController: UIViewController {  
    // When logging in  
    var username: String?  
    var password: String?  
  
    // After logging in  
    var loggedInUser: User?  
}
```

# Isolation Done Right™

```
// For logging in
class LoginViewModel {
    var username: String?
    var password: String?

    func logIn() -> UserViewModel?
}
```

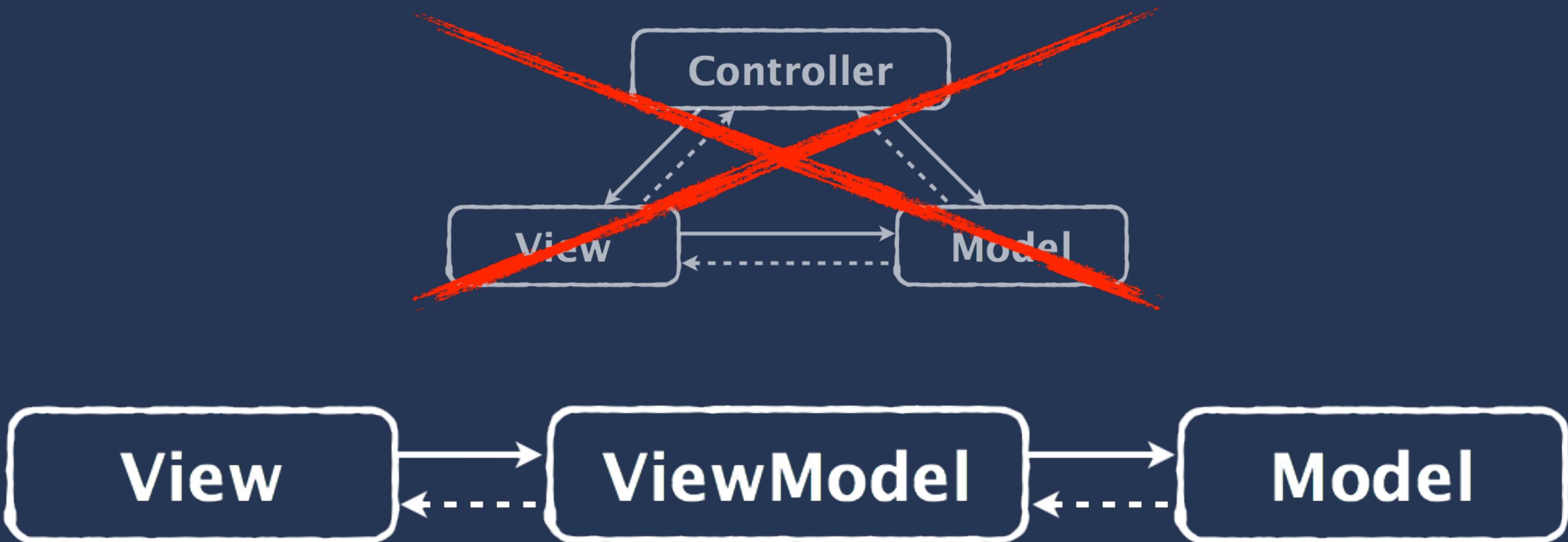
```
// After logging in
class UserViewModel {
    var loggedInUser: User?
}
```

# Stateless core, stateful shell

- Keep core **domain logic** in completely immutable value types
- Add **stateful shell objects** with mutable references to the immutable data

*See Gary Bernhardt's talk, "Boundaries"*

# Model-View-ViewModel



# Model-View-ViewModel

```
struct User { ... }
```

```
class UserViewModel {
    var loggedInUser: User?

    func logOut() {
        loggedInUser = nil
    }
}
```

**Globalis:  
Just say No**

**Globals get mixed in to  
every part  
of your program**

**Isolation reduces complexity  
Globals compound it**

**Singletons  
are global state**

Let's just pass  
instances  
around instead

# Example: Singleton Networking

```
class APIClient {  
    // Access the singleton with APIClient.sharedClient  
    class var sharedClient: APIClient {  
        struct Singleton {  
            static let instance = APIClient()  
        }  
  
        return Singleton.instance  
    }  
  
    // Fetches the top-level list of categories  
    func fetchCategories() -> [Category]  
}
```

# *Example: Instance Networking*

```
class APIClient {  
    // Fetches the top-level list of categories  
    func fetchCategories() -> [Category]  
}
```

# *Example: Instance Networking*

```
class MyViewController: UIViewController {  
    let client: APIClient  
  
    designated init(client: APIClient) {  
        super.init(nibName: nil, bundle: nil)  
    }  
  
    override func viewDidAppear(animated: Bool) {  
        super.viewDidAppear(animated)  
  
        client.fetchCategories()  
    }  
}
```

**Easily testable**  
**Explicit dependencies**  
**More flexible**

**Values  
Purity  
Isolation**

Ti

DR

**Minimize state  
Minimize complexity**

# Learning More

**WWDC 2014**

**Session 229**

**"Advanced iOS Application**

**Architecture and Patterns"**

**Check out ReactiveCocoa**  
**[github.com/ReactiveCocoa/ReactiveCocoa](https://github.com/ReactiveCocoa/ReactiveCocoa)**

**Haskell**  
**book.realworldhaskell.org**

**Elm**  
**elm-lang.org**

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# and you!