WHAT IS TESTING AND WHY DO IT?

» Testing most relevant for projects that are intended to live past initial ship date.

» Testing is a way to objectively verify quality.

» We already test our code by stepped through our code and using the debugger.

» What are some problems with testing our code this way?

» Writing unit tests is a way for us to write test code that is not shipped with production code.

TYPES OF SOFTWARE TESTS

» There are many types of software tests, such as security testing, installation testing, accessibility testing, etc. Software Testing

» Software testing and QA (Quality Assurance) is a separate dicipline.

» We are only concerned about unit testing, today.

» Xcode has an interface testing framework which we won't be covering today.

» Unit testing tests small units of code, usually functions/methods.

» Unit tests are distinct from integration tests (or functional tests).

» Integration tests test larger chunks of code and how they function together. This might involve hitting an actual network.

ADVANTAGES OF UNIT TESTING

» We spend more time writing code rather than hanging out in the debugger.

» Find bugs early in the development process.

» Provides living documentation.

» Guides better code architecture.

» Allows us to make changes to our code with more confidence.

» Catches regression bugs in later versions.

» Forces us to reason more thoroughly about our code.

» Sleep better at night. zzz

DISADVANTAGES OF UNIT TESTING

» We write a lot more code!

» It takes developer time away from adding exciting features.

» Not as exciting as adding features.

» If done incorrectly it can hamper progress.

TDD (TEST DRIVEN DEVELOPMENT)

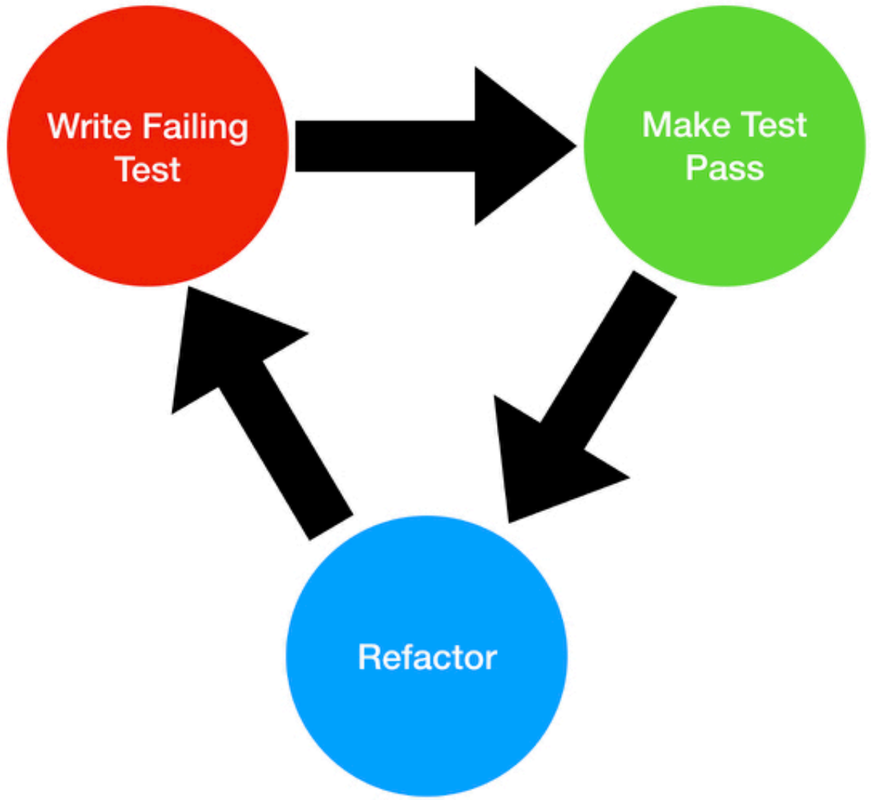
» TDD is the discipline of writing unit tests first, before production code.

» Sometimes called "Red, Green, Refactor".

Steps:

1. Write a single failing test.
2. Write the simplest code to make that test pass.
3. Refactor your production code and test code.

RED, GREEN, REFACTOR



SOME BEGINNING RULES

» Only ever test publicly exposed methods. Why?

» Never test Apple's code!

» Never test actual API calls. Why?

» Simple classes/functions are much easier to test. So, make your classes/functions simpler. 🧘

THE 3 A'S OF UNIT TESTING

1. Arrange.
2. Act.
3. Assert.

```
// Arrange

// Act

// Assert
```

3 TYPES OF UNIT TESTS:

1. Return Value
2. State Test
3. Interaction Test

1) RETURN VALUE TEST:

» calling a function returns a value.

» compare it to an expected value.

Return Value Test

2) STATE TEST:

» calling a function causes a side effect (like a property changes value).

» query the object to see if the changed state matches your expectations.

State Test

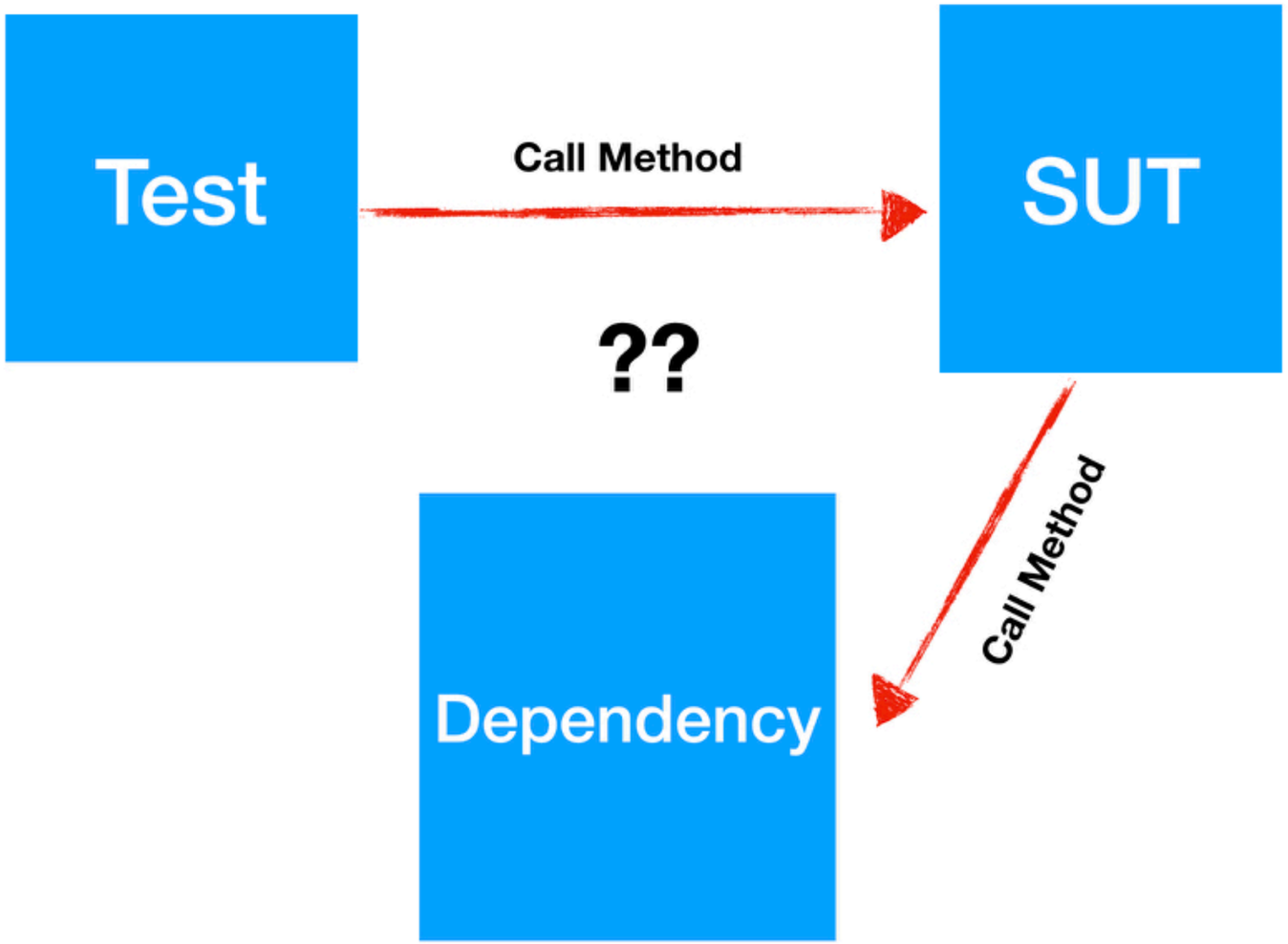
3) INTERACTION TEST:

» Your test calls a method and that method calls something else.

» Eg. Your PersonManager has a saveUser method that saves the passed in Person to UserDefaults.

» We don't want to use the actual UserDefaults to test this. Why not?

Interaction Test



INTERACTION TESTS & DEPENDENCY INJECTION

» Before we talk about the 2 types of interaction tests, let's take a closer look at dependencies.

» When you are doing interaction testing your sut (System Under Test) is dependent on other classes or modules.

» We usually want to use fake dependencies and not real ones.

» We always want to make sure we "inject" these dependencies rather than "new them up" internally.

```
// Wrong
class PersonManager {
  private let defaults: UserDefaults
  init() {
    defaults = UserDefaults.standard
  }
}

// Right
class PersonManager {
  private let defaults: UserDefaults
  init(defaults: UserDefaults) {
    self.defaults = defaults
  }
}
```

4 WAYS OF DOING DEPENDENCY INJECTION:

1. Extract & Override
2. Method Injection
3. Property Injection
4. Constructor Injection

1) EXTRACT & OVERRIDE:

» Handy when you can't change method signatures.

» Fragile if you refactor the name of the extracted method (which is only an internal dependency).

```
// Wrong
class PersonManager {

func save(person: Data){
    let defaults = UserDefaults.standard
    defaults.setValue(person, forKey: "personKey")
    }
}

// Right
class PersonManager {

  func save(person: Data){
    defaults().setValue(person, forKey: "personKey")
    }

  func defaults()->UserDefaults {
    return UserDefaults.standard
  }
}
```

```
// Subclass & Override

class TestablePersonManager: PersonManager {
  override func defaults() -> UserDefaults {
    return //something?
  }
}
```

» What is the problem here?

2) METHOD INJECTION:

» Pass the dependency in via a parameter to the method.

» Available only if you have the power to change the method signature.

```
class PersonManager {

func save(person: Data, with defaults: UserDefaults){
defaults.setValue(person, forKey: "personKey")
  }
}
```

3) PROPERTY INJECTION:

```
class PersonManager {

  var defaults: UserDefaults?

  func save(person: Data){
    defaults?.setValue(person, forKey: "personKey")
  }
}
```

4) CONSTRUCTOR INJECTION:

» Passes in the dependencies as parameter(s) to the initializer.

» Prefer constructor injection because it makes the dependencies more explicit.

```
class PersonManager {

  var defaults: UserDefaults

  init(defaults: UserDefaults) {
    self.defaults = defaults
  }

  func save(person: Data){
    defaults.setValue(person, forKey: "personKey")
  }

}
```

STUBS VS MOCKS

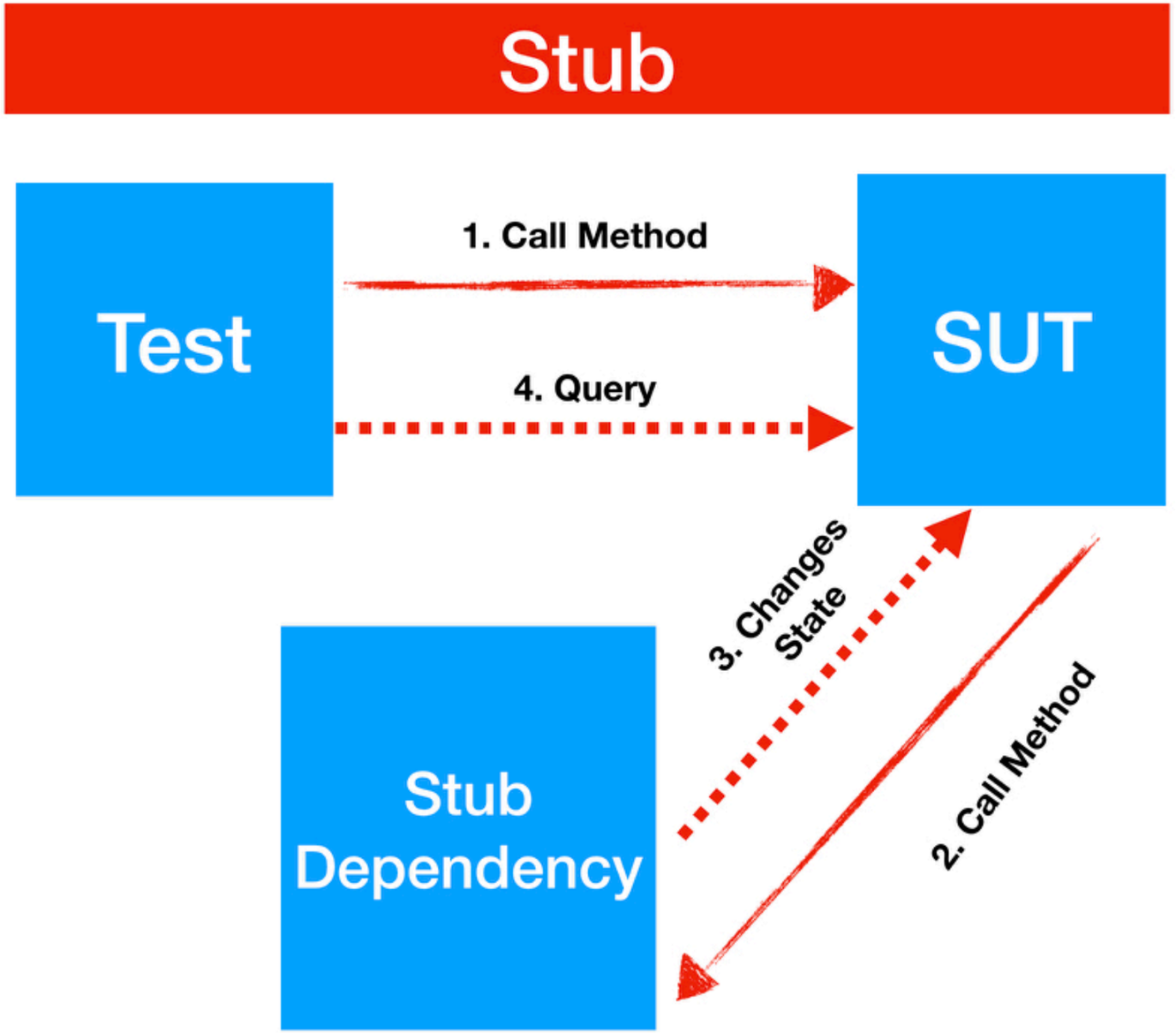
» We usually don't want to inject an actual defaults object or whatever other dependency. We want a fake of some kind that we can control.

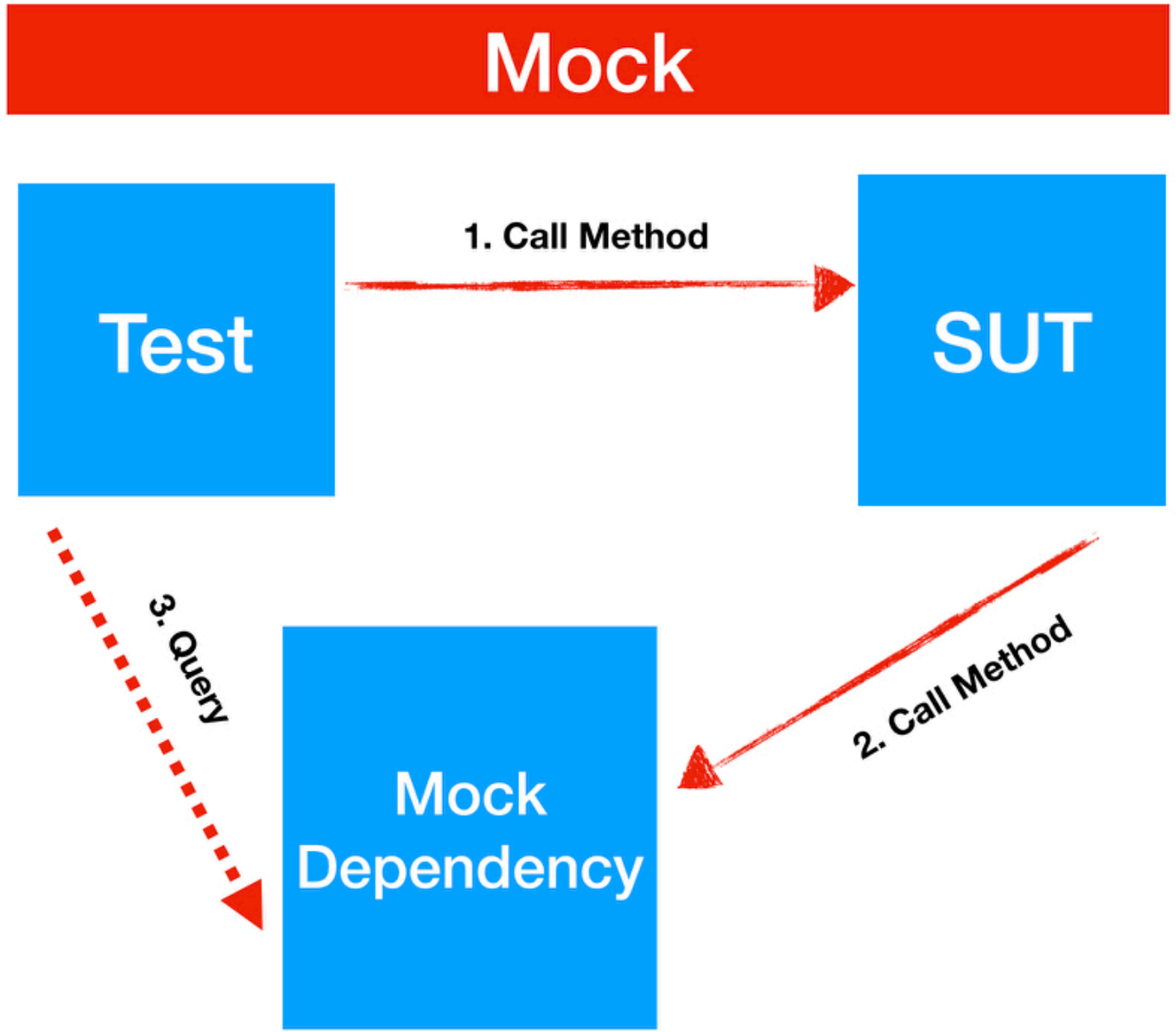
» There are 2 fundamental types of fake objects: Stubs and Mocks.

» The difference has to do with what object the test queries.

» For stubs, the test queries the sut for state changes.

» For mocks, the tests query the mock object for changes.


Stub
Test
1. Call Method
SUT
4. Query
3. Changes State
2. Call Method
Stub Dependency


Mock
Test
1. Call Method
SUT
3. Query
2. Call Method
Mock
Dependency

@TESTABLE

```
import XCTest
@testable import UnitTests

class BillComputerTests: XCTestCase {
}
```

» removes need to make everything public or open in the file, or add the file to the test target.

» Do not add the production target to the test target!

RESOURCES

» if you want to start with TDD start with a codekata link

» Jon Reid's Quality Coding is a good site to start.

» A lot of the ideas in this lecture are inspired by this video.