Always give one hundred percent

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About me

Jakub Turek

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Motivation

Retrospective of a recent project:

- Team of 3 focused on unit testing & TDD.
- 9 months of work.
- 186 865 lines of Swift code.
- 4 960 files.
- 6 internal frameworks.
- 6 768 test cases.

Agenda

1. Introduction to unit-testing & TDD.
2. Engineering for testability.
3. Common obstacles:
   - view controllers,
   - views,
   - global functions.
4. Refactoring test code.
5. Test code generation.
6. Metrics.

Introduction to testing

Unit testing

A unit test is an automated piece of code that invokes ***a unit of work*** *in the system and then checks a single assumption about the behavior of that unit of work.*

— Roy Osherove, The art of unit testing

Good unit test

Traits of a good unit test:

- automated,
- fast,
- tests a single logical concept in the system,
- trustworthy,
- readable,
- maintanable.

TDD

TDD is a programming technique which combines writing a test before writing just enough production code to fulfill that test and refactoring.

— Kent Beck, Test-Driven Development by example

Typical response to TDD

We don't do TDD because:

1. We are not allowed to.
2. We don't have enough time.
3. **It didn't work for us***.

* *Might indicate feedback loop problems.*

TDD workflow

1. Red - write a failing test.
2. Green - write minimal amount of code to pass.
3. Refactor.

3 laws of TDD

1. You can't write any production code until you write a failing unit test.
2. You can't write more of a unit test than is sufficient to fail. *Not compiling is failing*.
3. You can't write more production code than is sufficient to pass currently failing unit test.

Demo

Engineering for testability

Pure functions

How to write testable code?

1. *Pass values to functions.*
2. *Return values from functions.*

— @mdiep, Matt Diephouse, Twitter

Boundaries

Boundaries by Gary Bernhardt

This talk is about using simple values (as opposed to complex objects) not just for holding data, but also as the boundaries between components and subsystems.

https://destroyallsoftware.com/talks/boundaries

Imperative shell, functional core

Imperative shell:

- real world dependencies,
- side-effects,
- stateful operations.

Functional core:

- decisions,
- purely functional transformations.

Demo

Resources

Controlling Complexity in Swift

https://academy.realm.io/posts/andy-matuschak-controlling-complexity/

Enemy of the State

https://speakerdeck.com/jspahrsummers/enemy-of-the-state

Imperative Shell, Functional Core Gist

https://tinyurl.com/y9cxblm8

Imperative Shell, Functional Core on iOS

https://jakubturek.com/imperative-shell-functional-core/

Dealing with massive controllers

Metrics (1/5)

Examine the largest files:

```
find Sources -name '*.swift' \
    | xargs wc -l \
    | sort -r
```

Metrics (2/5)

Output:

??? AllAssemblies.generated.swift

??? ContentController.swift

??? PickerController.swift

??? MapController.swift

??? ClassCell.swift

??? CalendarController.swift

??? ContactController.swift

??? AuthorizeController.swift

Metrics (3/5)

Actual line counts:

148 AllAssemblies.generated.swift
140 ContentController.swift
139 PickerController.swift
138 MapController.swift
138 ClassCell.swift
138 CalendarController.swift
137 ContactController.swift
135 AuthorizeController.swift

Metrics (4/5)

Examine the average controller size:

```
cloc Modules \
    --include-lang=Swift \
    --match-f='.+Controller\.swift'
```

Metrics (5/5)

- Controllers in total: 164.
- Screens in total: 38.
- Average 4.32 controller per screen.
- Lines in total: 12 327.
- Average 75.16 lines of code per controller.

More View Controllers

How to decouple controllers?

- ~~Never~~ Subclass as a last resort.
- Use child controllers for composition.
- Use protocols for controllers' boundaries.
- Refer to controllers using compound types (`UIViewController & ControllerProtocol`).

Adding a child controller

```
func embed(child: UIViewController,
           inside view: UIView) {
  addChildViewController(child)
  view.addSubview(child.view)

  child.snp.makeConstraints {
    $0.edges.equalToSuperview()
  }

  child.didMove(toParentViewController: self)
}
```

Decoupling controllers (1/2)

```
protocol ChildControllerType: class {
  var productSelected: ((String) -> Void)? { get set }
}

class ChildController: UIViewController,
                       ChildControllerType {
  init(/* dependencies */) { /* ... */ }

  var productSelected: ((String) -> Void)?

  override func viewDidLoad() {
    /* implementation */
  }
}
```

Decoupling controllers (2/2)

```
typealias ChildControlling =
      UIViewController & ChildControllerType

class ParentController: UIViewController {
  init(factory: () -> ChildControlling) {
    self.factory = factory
  }

  override func viewDidLoad() {
    super.viewDidLoad()
    embed(child: child, inside: view)
  }

  private lazy var child = factory()
  private let factory: () -> ChildControlling
}
```

Stubbing a child controller (1/2)

```
class ChildControllerStub: UIViewController,
                           ChildControllerType {
  var productSelected: ((String) -> Void)?
}
```

Stubbing a child controller (2/2)

```
class ParentControllerTests: XCTestCase {
  var childStub: ChildControllerStub!
  var sut: ParentController!

  override func setUp() {
    super.setUp()
    childStub = ChildControllerStub()
    sut = ParentController(factory: { childStub })
  }

  func testThatSelectedProductNameIsDisplayed() {
    childStub.productSelected?("Water")
    XCTAssertEqual(sut.view.label.text, "Water")
  }
}
```

Child view controller examples

- Buttons:
  - side-effects,
  - error handling,
  - interaction toggling.
- Forms:
  - user input validation,
  - complex presentation,
  - error handling.
- API data coordination. Immutable children:
  - data,
  - empty state,
  - error.

Views

iOSSnapshotTestCase

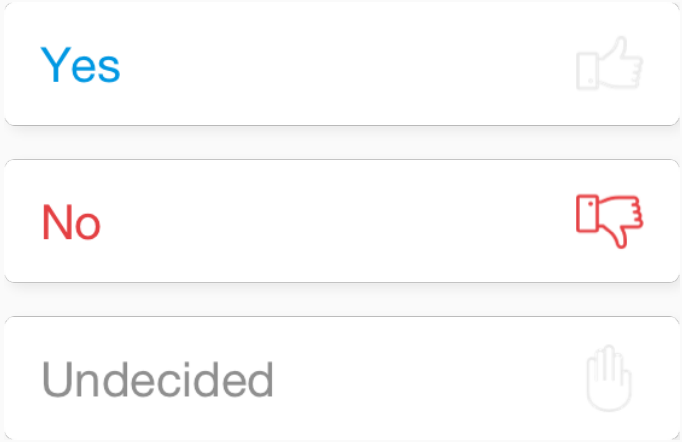
iOSSnapshotTestCase

`iOSSnapshotTestCase` takes preconfigured view and renders its snapshot. It compares snapshot to a “reference image” stored in repository and fails if the two images don’t match.

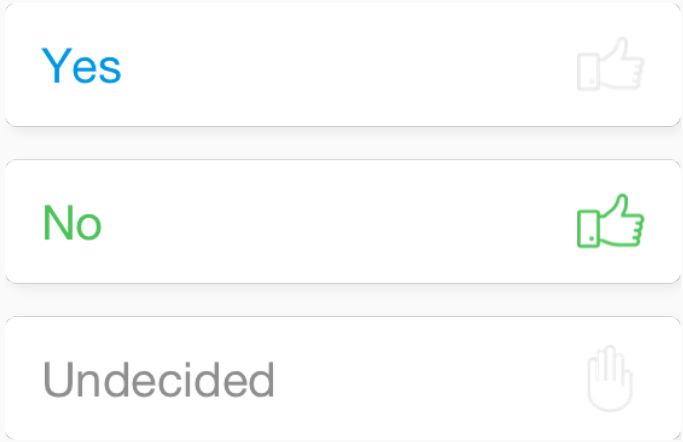
https://github.com/uber/ios-snapshot-test-case

iOSSnapshotTestCase diff

Expected



Actual

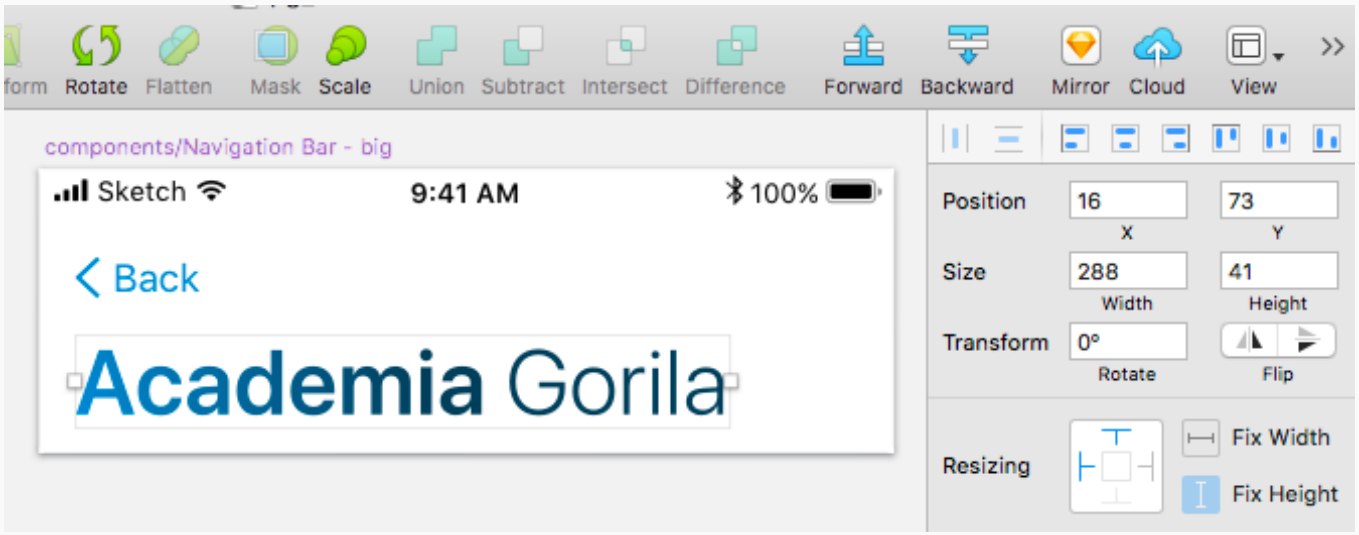


Diff

Instant feedback for views

Red phase (1/3)

Note down the size from design ($\approx 300 \times 40$).



Red phase (2/3)

```
override func setUp() {
  super.setUp()
  recordMode = true

  sut = GradientLabelView(text: "Academia Gorila")
  sut.frame = CGRect(width: 300, height: 40)
}

func testLabelMatchesSnapshot() {
  FBSnapshotVerifyView(sut)
}

class GradientLabelView { // ... implementation }
```

Red phase (3/3)

Build the view in iterations:

1. Change the code.
2. Run the tests.
3. Compare a reference image to the design:
   - Repeat the cycle if needed.

Green phase

```
override func setUp() {
  super.setUp()
  recordMode = false

  sut = GradientLabelView(text: "Academia Gorila")
  sut.frame = CGRect(width: 300, height: 40)
}

func testLabelMatchesSnapshot() {
  FBSnapshotVerifyView(sut)
}
```

Refactor phase

- Move the view to a production target.
- Refactor the view.

Testing global methods

Global method example (1/2)

```
extension UIImage {
  static func with(color: UIColor) -> UIImage? {
    let origin = CGPoint(x: 0, y: 0)
    let size = CGSize(width: 1, height: 1)
    let rect = CGRect(origin: origin, size: size)

    return CGContext.drawImage(of: size) { ctx in
      ctx.setFillColor(color.cgColor)
      ctx.fill(rect)
    }
  }
}
```

Global method example (2/2)

```
static func drawImage(of size: CGSize,
                      using drawer: (CGContext) -> Void)
                      -> UIImage? {
  UIGraphicsBeginImage...(size, false, 0.0)

  defer { UIGraphicsEndImageContext() }

  guard let ctx = UIGraphicsGetCurrentContext() else {
      return nil
  }

  drawer(ctx)

  return UIGraphicsGetImage...()
}
```

Swift namespace resolution (1/2)

Shipping your own controller type:

```
class UIViewController {
  func theTimeHasComeToLoadAView() {
    myOwnPersonalView = SomeView()
  }
}

let controller = UIViewController()
controller.theTimeHasComeToLoadAView() // works
```

Swift namespace resolution (2/2)

Shipping your own controller library:

```
# Podfile
pod 'MyOwnController', '~> 0.1'

// SourceFile.swift
import MyOwnController
import UIKit

UIViewController() // compilation error
```

Testing global methods (1/2)

```
import UIKit

func UIGraphicsGetImageFromCurrentImageContext()
      -> UIImage? {
  return imageFromContext()
}

var imageFromContext: () -> UIImage? =
  UIKit.UIGraphicsGetImageFromCurrentImageContext
```

Testing global methods (2/2)

```
override func setUp() {
  imageFromContext = { UIImage.catMeme }
}

override func tearDown() {
  imageFromContext = UIKit.UIGraphicsGetImage...
}

func testThatDrawImageReturnsImageFromContext() {
  let image = CGContext.drawImage(of: .zero) { _ in }

  XCTAssertEqual(
    UIImagePNGRepresentation(image),
    UIImagePNGRepresentation(imageFromContext())
  )
}
```

Refactoring test code

Testing models (1/2)

```
struct User {
  let id: Int
  let born: Date
}
```

Testing models (2/2)

```
func testThatUsersBornInJanuaryGetAPrize() {
  let u1 = User(
    id: 3,
    born: Date(timeIntervalSince1970: 631886400)
  )
  let u2 = User(
    id: 6,
    born: Date(timeIntervalSince1970: 634233600)
  )
  let u3 = User(
    id: 8,
    born: Date(timeIntervalSince1970: 727466400)
  )

  XCTAssertEqual(sut.winners([u1, u2, u3]), [3, 8])
}
```

Test data

```
extension User {
 static var bornJanuary1990: User {
  return User(id: 3, born: "1990-01-09 12:00".date())
 }

 static var bornFebruary1990: User {
  return User(id: 6, born: "1990-02-05 16:00".date())
 }

 static var bornJanuary1993: User {
  return User(id: 8, born: "1993-01-19 18:00".date())
 }
}
```

Refactored tests

```
func testThatUsersBornInJanuaryGetAPrize() {
  let winnerIDs = sut.winners([
    .bornJanuary1990,
    .bornFebruary1990,
    .bornJanuary1993
  ])

  XCTAssertEqual(winnerIDs, [3, 8])
}
```

Test code generation

Sourcery

Sourcery is a code generator for Swift language, built on top of Apple's own SourceKit. It extends the language abstractions to allow you to generate boilerplate code automatically.

https://github.com/krzysztofzablocki/Sourcery

Problem: required initializers

0% code coverage when not using inteface builder 😭

```
required init?(coder aDecoder: NSCoder) {
  return nil
}
```

AllViews.stencil

```
extension UIView {

 static var allInitializers: [(NSCoder) -> UIView?] {
  return [{% for view in types.classes where view.based.UIView %}
   {% set spacer %}{% if not forloop.last %},{% endif %}{% endset %}
    {% for initializer in view.initializers %}
    {% if initializer.selectorName == "init(coder:)" %}
     {{ view.name }}.init(coder:){{ spacer }}
    {% endif %}
    {% endfor %}
   {% endfor %}]
 }

}
```

AllViews.generated.swift

```swift
extension UIView {

  static var allInitializers: [(NSCoder) -> UIView?] {
    return [
      ActionBarView.init(coder:),
      AuthorizeErrorView.init(coder:),
      BlurView.init(coder:),
      BorderedButtonView.init(coder:),
      FilterView.init(coder:),
      HeaderView.init(coder:),
      /* ... */
    ]
  }

}
```

AllViewsTests.swift

```
func testThatAllViewsAreNonCodable() {
  UIView.allInitializers.forEach { initializer in
   XCTAssertNil(initializer(NSCoder()))
  }
}
```

Other usages

- Automatic synthesizing of `Equatable` conformance in extensions.
- Mock object generation.
- Complex assertions:
  - There is a factory class for every `Route`.
  - There is an integration test for every request.

Metrics

Metrics

Measured on every pull request:

- Project size:
  - lines of code,
  - files count,
  - average file size.
- Static analysis:
  - `SwiftLint`: consistent coding style,
  - `jscpd`: automatic copy-paste detection.
- Code coverage.

Metrics - visualization

Danger

`Danger` runs during your CI process, and gives teams the chance to automate common code review chores.

http://danger.systems/js/swift.html

Danger

ELDangerBot commented 7 days ago • edited

	2 Warnings
⚠️	PR is classed as Work in Progress
⚠️	Big PR

SwiftLint found issues

Warnings

File	Line	Reason
LoginFieldView.swift	21	Lines should not have trailing whitespace.

Generated by Danger

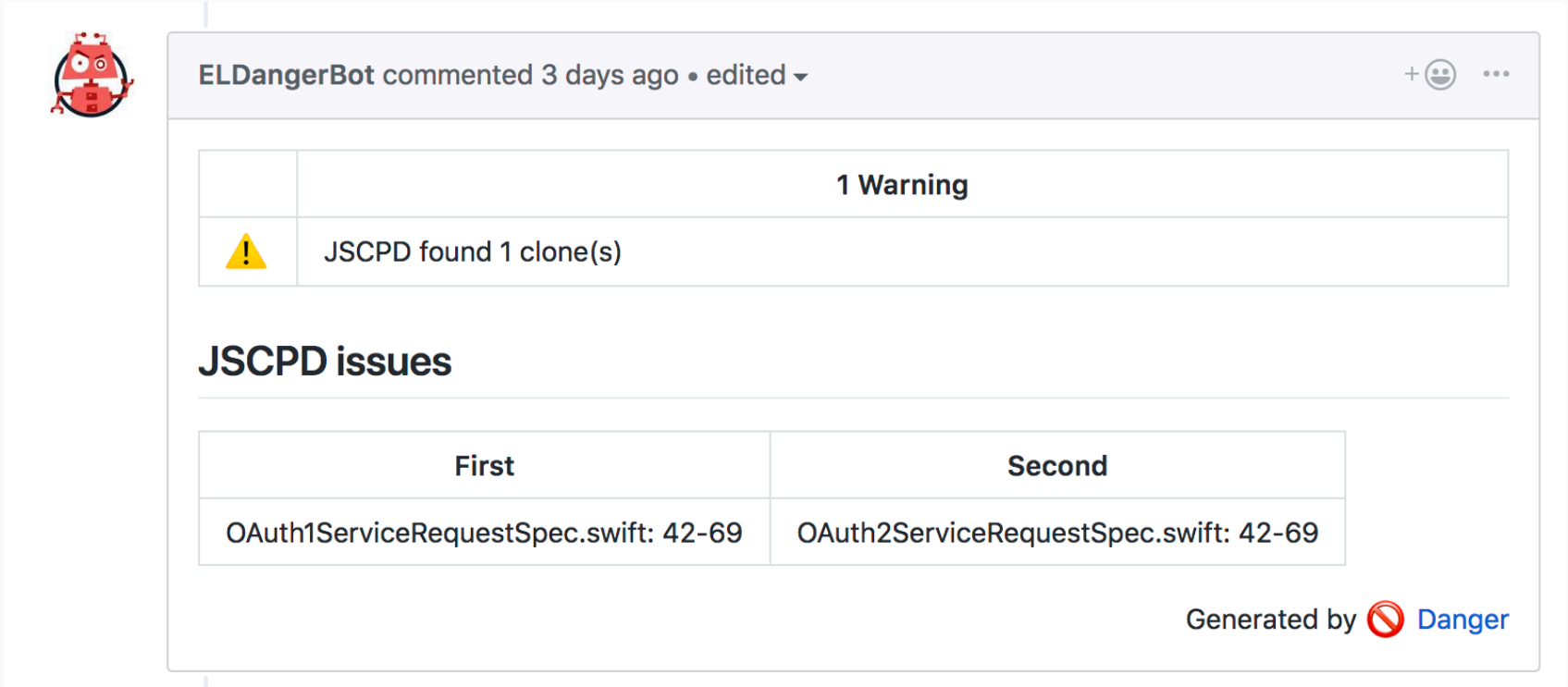
Automatic copy-paste detection

JSCPD

`jscpd` is a tool for detect copy/paste ”design pattern” in programming source code.

https://github.com/kucherenko/jscpd

JSCPD + Danger = ❤️ (1/3)



JSCPD + Danger = ❤️ (2/3)

cpd.yaml:

```
languages:
  - swift
files:
  - "Sources/**"
exclude:
  - "**/*.generated.swift"
reporter: json
output: jscpd_report.json
```

JSCPD + Danger = ❤️ (3/3)

Dangerfile:

```
def find_duplicates
  `jscpd`

  rep = JSON.parse(File.read('jscpd_report.json'))
  clones = rep["statistics"]["clones"]

  if clones > 0
    warn("JSCPD found #{clones} clone(s)")
  end
end
```

Full version: https://tinyurl.com/yc23t4mb

Code coverage

Code coverage is a percentage of code which is covered by automated tests.

> *Test coverage is a useful tool for finding untested parts of a codebase. Test coverage is of little use as a numeric statement of how good your tests are.*
>
> — *Martin Fowler, TestCoverage*

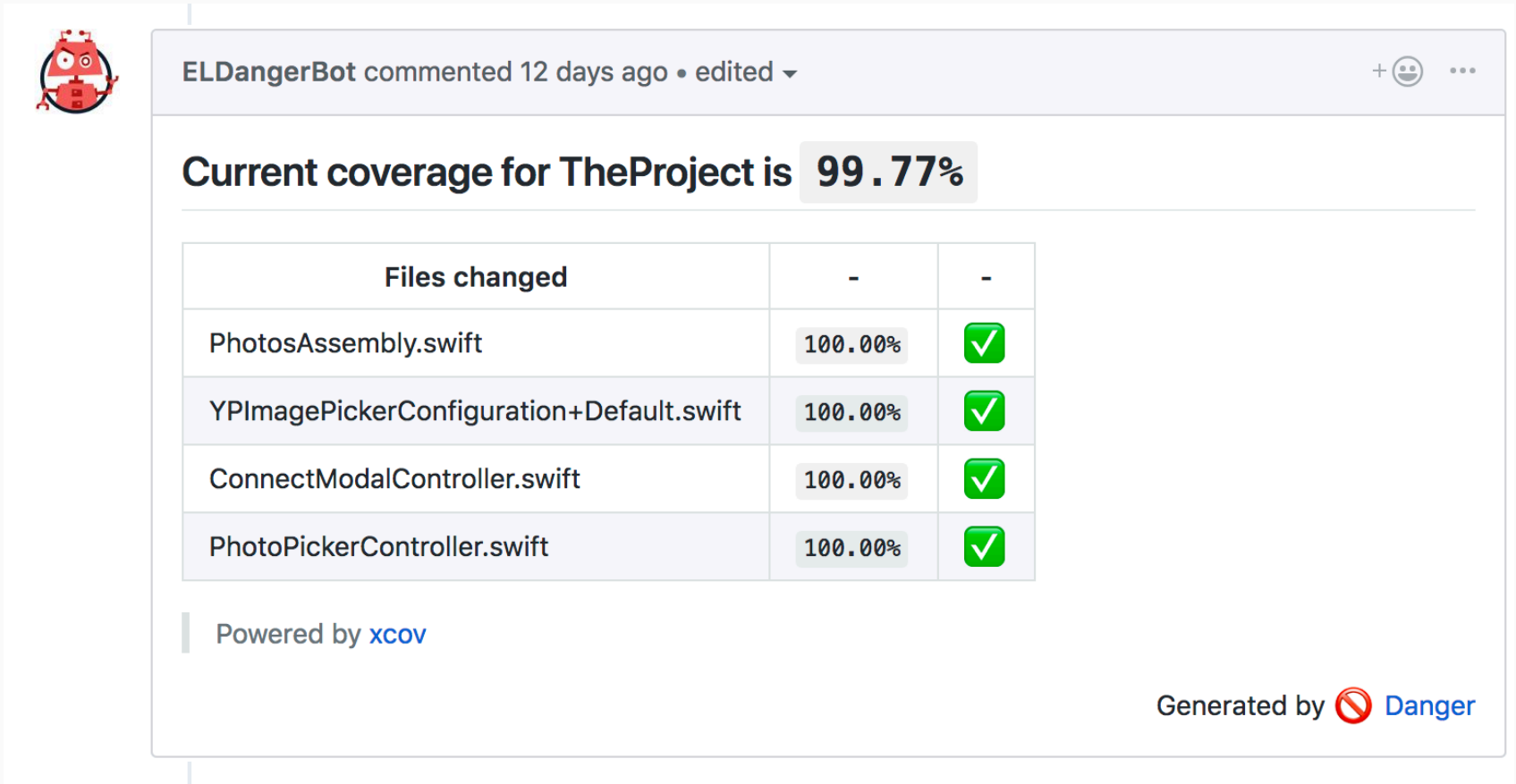
DANGER-XCOV (1/2)

danger-xcov

`danger-xcov` is the Danger plugin of xcov, a friendly visualizer for Xcode's code coverage files.

https://github.com/nakiostudio/danger-xcov

DANGER-XCOV (2/2)



Thank you!

Additional resources

- Jakub Turek
  Always give one hundred percent
  https://jakubturek.com/talks/
- Jon Reid
  Quality Coding - Blog
  https://qualitycoding.org/blog/
- Kasper B. Graversen
  Gist: functional core, imperative shell
  https://tinyurl.com/y9cxblm8

Feedback ❤️

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