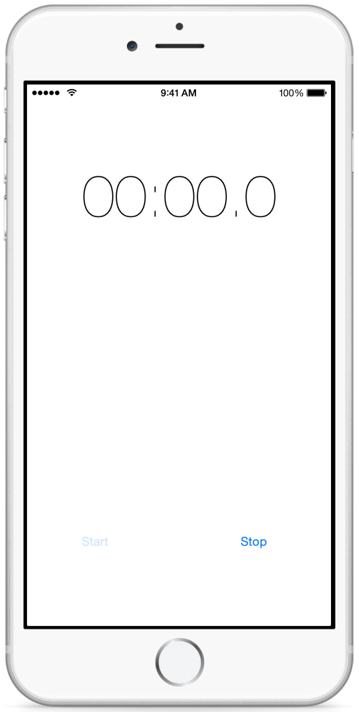
Stopwatch
Lesson 4



Description

Implement a naive updating of the elapsed time, to illustrate the nature of the application main run loop and the consequences of long-running operations on UI responsiveness.

Learning Outcomes

- Analyze application behavior and user expectations to define a requirements statement.
- Experiment with loops in interface event handlers and evaluate how long-running code can block a thread of execution.
- Infer how controller code can unintentionally hinder interface responsiveness.

Vocabulary

computed property	accessor	outlet
`@IBOutlet`	implicitly unwrapped optional	`UILabel`
blocking	run loop	

Materials

- **Stopwatch Lesson 4** Xcode project
- **Run Loops and NSTimer** presentation

Opening

How might we continuously display the elapsed time in the view?

Agenda

- Discuss the desired behavior of the elapsed time label, and what users expect to happen while the stopwatch is running.
- Consider, "While the stopwatch is running, the controller should update the elapsed time label."
- Modify the `Stopwatch` model, adding a computed property to indicate that the `Stopwatch` is running.

```
var isRunning: Bool {
   return startTime != nil
}
```

- Explain the shorthand read-only computed property syntax, the `Bool` data type, and how comparing the `startTime` optional property to `nil` can indicate if the `Stopwatch` is running.
- Using Interface Builder and the Assistant Editor (⌥⌘↩), add an outlet for the elapsed time label to the controller class.

```
@IBOutlet weak var elapsedTimeLabel: UILabel!
```

- Explain the property declaration, the significance of the `@IBOutlet` attribute, and the implicitly unwrapped optional syntax.
- Using the Xcode Documentation and API Reference (⇧⌘0), explore the `UILabel` class reference.
- Add a naive implementation of `startButtonTapped:`.

```
@IBAction func startButtonTapped(sender: UIButton) {
   print("Starting stopwatch")
   stopwatch.start()
   while stopwatch.isRunning {
      print("Updating...")
      elapsedTimeLabel.text = "\(stopwatch.elapsedTime)"
   }
}
```

- Run the app (⌘R), tap the Start button, observe the console (⇧⌘C), and notice how the Start button remains tapped.
- Discuss how `startButtonTapped:` never returns, preventing the view from being visibly updated.

- Present the concept of run loops, and how long-running tasks can block the interface responsiveness.

Closing

Have you experienced using apps that lose their interface responsiveness?

Modifications and Extensions

- Convert the the `isRunning` computed property to a stored property, and implement your own custom accessor method. Critique the benefits and drawbacks of both approaches.

Resources

The Swift Programming Language: Classes and Structures https://developer.apple.com/library/ios/documentation/Swift/Conceptual/Swift_Programming_Language/ClassesAndStructures.html

The Swift Programming Language: Computed Properties https://developer.apple.com/library/ios/documentation/Swift/Conceptual/Swift_Programming_Language/Properties.html#//apple_ref/doc/uid/TP40014097-CH14-ID259

Xcode Overview: Connect User Interface Objects to Code https://developer.apple.com/library/ios/documentation/ToolsLanguages/Conceptual/Xcode_Overview/edit_user_interface.html#//apple_ref/doc/uid/TP40010215-CH6-SW3

The Swift Programming Language: Implicitly Unwrapped Optionals https://developer.apple.com/library/ios/documentation/Swift/Conceptual/Swift_Programming_Language/TheBasics.html#//apple_ref/doc/uid/TP40014097-CH5-ID334

Start Developing iOS Apps Today: Finding Information https://developer.apple.com/library/ios/referencelibrary/GettingStarted/RoadMapiOS/FindingInformation.html

Threading Programming Guide: Run Loops https://developer.apple.com/library/ios/documentation/Cocoa/Conceptual/Multithreading/RunLoopManagement/RunLoopManagement.html