iOS Apps with REST APIs

Building Web-Driven Apps in Swift

Christina Moulton

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9. Loading UITableViewCell Images from an API

So far we've set up a Swift app that fetches and displays gists from the GitHub API. To do so it:

- Pulls public gists data from the GitHub gists API
- Turns the JSON response into an array of Swift structs
- Displays the results in a table view

In this chapter, we'll add a new feature: displaying images of the gist owner's avatar image in each row in the table view. We'll get the URLs from the API then load the images asynchronously so that the UI isn't held up while they're loading. We'll have to handle table view cells getting reused while we're retrieving the images and we'll set up an image cache so we don't have to pull down the images every time a cell gets displayed.

If your API has images for your main items then follow along with this section. Otherwise, you might want to skip it and come back when you do need to load images from URLs, even if they're not in a table view.

Here's what it'll look like when we're done:

Final cell images

If you haven't been following along, you might want to grab the code that'll be our starting point from GitHub (tagged "tableview")[1].

Or if you'd rather not type, grab the completed code from this chapter (tagged "cell_images")[2].

[1] https://github.com/cmoulton/grokSwiftREST_v1.4/releases/tag/tableview
[2] https://github.com/cmoulton/grokSwiftREST_v1.4/releases/tag/cell_images

9.1 Loading Images from URLs

We've already set up our Gist class to parse out the gist owner's avatar URL using `Codable`.

```
struct Gist: Codable {
  struct Owner: Codable {
    var login: String
    var avatarURL: URL?

    enum CodingKeys: String, CodingKey {
      case login
      case avatarURL = "avatar_url"
    }
  }

  var id: String?
  var gistDescription: String?
  var url: URL?
  var owner: Owner?

  enum CodingKeys: String, CodingKey {
    case id
    case gistDescription = "description"
    case url
    case owner
  }
}
```

So we have everything set up to retrieve the image URLs. Now we need to get the actual image data from that URL. Adding to our `GitHubAPIManager`:

```
class GitHubAPIManager
{
  // ...

  func imageFrom(url: URL,
    completionHandler: @escaping (UIImage?, Error?) -> Void) {
    Alamofire.request(url)
      .responseData { response in
        guard let data = response.data else {
          completionHandler(nil, response.error)
          return
        }


        let image = UIImage(data: data)
```

```
        completionHandler(image, nil)
    }
  }
}
```

That function will take the image URL and use it to make a GET request. When we get the results (as `Data` since we're using `.responseData`) we check that there is data and if so try to turn it into an image. Then we pass that image back in the completion handler.

For this request we're not using `Codable` because the response that we expect is just the data that represents the image. It's not wrapped in JSON or any other format so we can just access the data directly by using `response.data`.

9.2 UITableViewCell Images from URLs

Now we can hook up displaying images. In MasterViewController's `tableView:(cellForRowAt indexPath:)`:

```
override func tableView(_ tableView: UITableView, cellForRowAt indexPath: IndexPath)
  -> UITableViewCell {
  let cell = tableView.dequeueReusableCell(withIdentifier: "Cell", for: indexPath)

  let gist = gists[indexPath.row]
  cell.textLabel?.text = gist.description
  cell.detailTextLabel?.text = gist.owner?.login

  cell.imageView?.image = nil
  if let url = gist.owner?.avatarURL {
    GitHubAPIManager.shared.imageFrom(url: url) {
      (image, error) in
      guard error == nil else {
        print(error!)
        return
      }
      if let cellToUpdate = self.tableView?.cellForRow(at: indexPath) {
        cellToUpdate.imageView?.image = image // will work fine even if image is nil
        // need to reload the view, which won't happen otherwise
        // since this is in an async call
        cellToUpdate.setNeedsLayout()
      }
    }
  }

  return cell
}
```

We check that we have a URL for the image: `if let url = gist.owner?.avatarURL`. If so we fire off the method that we just wrote. Before we make that call, we set the image to nil in case the cell is being reused. We don't want the image from another gist showing up until we get a response to the network request:

```
cell.imageView?.image = nil
if let url = gist.owner?.avatarURL {
  GitHubAPIManager.shared.imageFrom(url: url) {
    // ...
  }
}
```

In the completion handler we first check for errors:

```
GitHubAPIManager.shared.imageFrom(url: url) {
  (image, error) in
  guard error == nil else {
    print(error!)
    return
  }
  if let cellToUpdate = self.tableView?.cellForRow(at: indexPath) {
    cellToUpdate.imageView?.image = image // will work fine even if image is nil
    // need to reload the view, which won't happen otherwise
    // since this is in an async call
    cellToUpdate.setNeedsLayout()
  }
}
```

If we don't have an error we set the image that we received as the cell's image. This is a bit complicated by the fact that our `imageFrom(url:)` function is asynchronous and by how table views reuse cells. Since we're using `dequeueReusableCell(withIdentifier: for: indexPath)` the table view will reuse cells that have scrolled off of the screen. For example, if we have 20 gists but can only see 10 cells on the screen at once the table view will only create about 12 or 14 cells. If our cell has scrolled off of the screen then we shouldn't set the image since that cell might end up being used to display a different gist.

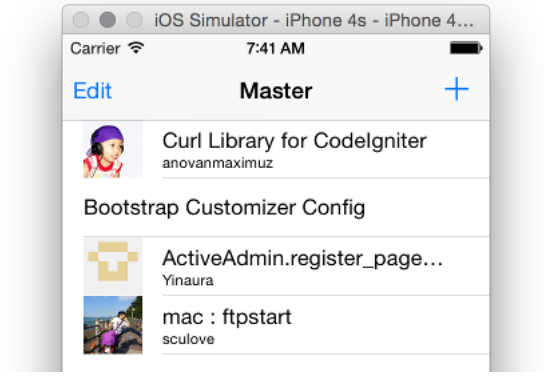
We can work around this problem by using the index path to get the correct cell, if one exists, once we have the image:

```
if let cellToUpdate = self.tableView?.cellForRow(at: indexPath)
```

If the cell is currently being shown, that'll give us the cell that's on the screen for our index path. Then we can set the image on that cell. Since we're all async here we also need to tell the cell that we've changed part of its view and it needs to redraw itself by using `cellToUpdate.setNeedsLayout()`. Otherwise the image wouldn't get updated.

Note that we don't need to check if our image is nil before setting it to the cell's `imageView`. If the image is nil then `cellToUpdate.imageView?.image = image` will blank out the cell's image.

Save and run. You should now see avatars for each gist as long as the user has set one:



If your API has images, set them up to load as we did in this section.

9.3 Enhancements

We're firing off requests to get the images for each cell but sometimes by the time we get the result we don't need it anymore. An optimization would be to cancel the network requests when the cell scrolls off of the screen. If you're dealing with lots of images you'd want to do that (you'll know you need it if the scrolling isn't smooth). Our scrolling seems pretty smooth and we're going to add a cache, so this concern isn't one that needs to be addressed right now.

An optimization that is worthwhile even for this small app is caching the images so we don't have to grab them from the web every time they're shown. We'll implement a quick and easy single-run-of-the-app cache to see how it can work. Then we'll replace our cache with `PINRemoteImage` which will give us a smarter persistent cache.

9.4 Caching Images

In our `MasterViewController` we can add a dictionary to hold the images indexed by their absolute URL string:

```
var imageCache: [String: UIImage?] = [:]
```

Now we can save the images when we get them:

```
if let url = gist.owner?.avatarURL {
  GitHubAPIManager.shared.imageFrom(url: url) {
    (image, error) in
    guard error == nil else {
      print(error!)
      return
    }

    // Save the image so we won't have to keep fetching it if they scroll
    self.imageCache[url.absoluteString] = image

    if let cellToUpdate = self.tableView?.cellForRow(at: indexPath) {
      cellToUpdate.imageView?.image = image // will work fine even if image is nil
      // need to reload the view, which won't happen otherwise
      // since this is in an async call
      cellToUpdate.setNeedsLayout()
    }
  }
}
```

Before retrieving the image, we'll check the cache to see if we already have it:

```
override func tableView(_ tableView: UITableView,
  cellForRowAt indexPath: IndexPath) -> UITableViewCell {
  let cell = tableView.dequeueReusableCell(withIdentifier: "Cell", for: indexPath)

  let gist = gists[indexPath.row]
  cell.textLabel?.text = gist.gistDescription
  cell.detailTextLabel?.text = gist.owner?.login

  cell.imageView?.image = nil

  if let url = gist.owner?.avatarURL {
    if let cachedImage = imageCache[url.absoluteString] {
      cell.imageView?.image = cachedImage
    } else {
      GitHubAPIManager.shared.imageFrom(url: url) {
        (image, error) in
        // ...
        }
      }
    }
  }

  return cell
}
```

So finally our `tableView(: cellForRowAt indexPath:)` function will look like:

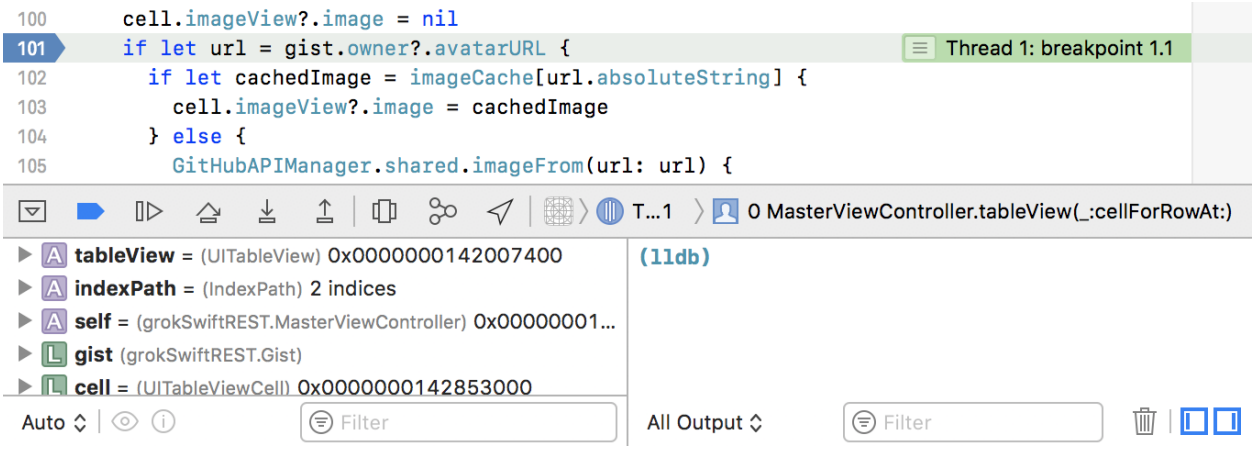
```
override func tableView(_ tableView: UITableView,
  cellForRowAt indexPath: IndexPath) -> UITableViewCell {
  let cell = tableView.dequeueReusableCell(withIdentifier: "Cell", for: indexPath)

  let gist = gists[indexPath.row]
  cell.textLabel?.text = gist.gistDescription
  cell.detailTextLabel?.text = gist.owner?.login

  cell.imageView?.image = nil
  if let url = gist.owner?.avatarURL {
    if let cachedImage = imageCache[url.absoluteString] {
      cell.imageView?.image = cachedImage
    } else {
      GitHubAPIManager.shared.imageFrom(url: url) {
        (image, error) in
        guard error == nil else {
          print(error!)
          return
        }

        // Save the image so we won't have to keep fetching it if they scroll
        self.imageCache[url.absoluteString] = image

        if let cellToUpdate = self.tableView?.cellForRow(at: indexPath) {
          cellToUpdate.imageView?.image = image // will work fine even if image is nil
          // need to reload the view, which won't happen otherwise
          // since this is in an async call
          cellToUpdate.setNeedsLayout()
        }
      }
    }
  }

  return cell
}
```

To test out this code you'll have to set a breakpoint and step through to see which lines get executed. To add a breakpoint, click on the line number next to the code where you want the code execution to stop:

```
100      cell.imageView?.image = nil
101      if let url = gist.owner?.avatarURL {
102        if let cachedImage = imageCache[url.absoluteString] {
103          cell.imageView?.image = cachedImage
104        } else {
105          GitHubAPIManager.shared.imageFrom(url: url) {
106            (image, error) in
107            guard error == nil else {
108              print(error!)
109              return
110            }
```

Adding a breakpoint

Then run the app. When it gets to the breakpoint the code will stop running. At that point you can use the panel at the bottom of Xcode to examine variables and step through the code:



Stopped at breakpoint

Click on the "step over" button to go to the next line of code:

Step over button

Watch which code path gets taken by seeing which line is highlighted. If there is an `avatarURL` it will try to load it:

```
100     cell.imageView?.image = nil
101     if let url = gist.owner?.avatarURL {
102       if let cachedImage = imageCache[url.absoluteString] {
103         cell.imageView?.image = cachedImage
104       } else {
105         GitHubAPIManager.shared.imageFrom(url: url) {          Thread 1: step over
106           (image, error) in
107           guard error == nil else {
108             print(error!)
109             return
110           }
```

Load image

To resume the program until the next time the breakpoint is hit, click the continue button:

Continue button

When you run the app all of the images will get loaded from their URLs the first time that they're displayed because we're not persisting the image cache between runs of the app. We'll fix that in the next section. Since table view cells get reused, our cache will kick in when we scroll cells on and off of the screen. The easiest way to see when the cache gets used is to move the breakpoint to where we're loading an image from the cache:

```
100     cell.imageView?.image = nil
101     if let url = gist.owner?.avatarURL {
102       if let cachedImage = imageCache[url.absoluteString] {
103         cell.imageView?.image = cachedImage                    Thread 1: breakpoint 2.1
104       } else {
105         GitHubAPIManager.shared.imageFrom(url: url) {
106           (image, error) in
107           guard error == nil else {
108             print(error!)
109             return
110           }
```

Loading image from cache

After the initial cells load, scroll up and down. You should hit the breakpoint and see that line getting executed.

9.5 A Better Cache: PINRemoteImage

We've set up our API calls to parse an image URL out of JSON, then to load the image from the URL. We then used those images in UITableViewCells, handling the asynchronous loading even though the cells might have been reused. We set up a primitive cache for a single run of the app that helps

us avoid constantly reloading the images. Before using this code in a released app it would be worth setting up a persistent cache that's used for multiple runs of the app.

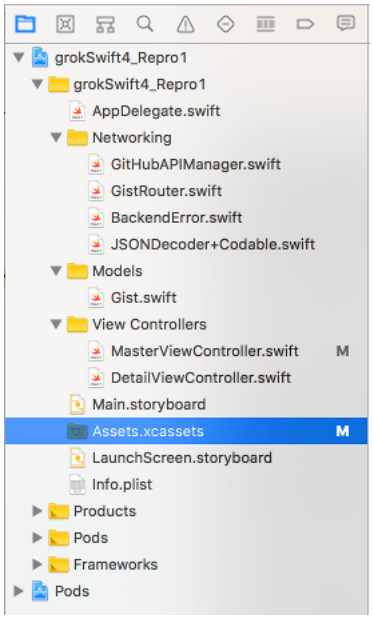
PINRemoteImage[3] is a persistent image caching library. Using this cache will make sure that images are only loaded once. It's also simpler to integrate than our non-persistent cache.

Add PINRemoteImage v 2.1 to your project using CocoaPods. Import it into the `MasterViewController` file and remove our simple cache:

```
import UIKit
import PINRemoteImage

class MasterViewController: UITableViewController {

  var detailViewController: DetailViewController? = nil
  var gists = [Gist]()
  var imageCache: [String: UIImage?] = [:]

  \\ ...

  override func tableView(_ tableView: UITableView, cellForRowAt indexPath: IndexPath) -> UITa\
bleViewCell {
    let cell = tableView.dequeueReusableCell(withIdentifier: "Cell", for: indexPath)

    let gist = gists[indexPath.row]
    cell.textLabel?.text = gist.gistDescription
    cell.detailTextLabel?.text = gist.owner?.login

    cell.imageView?.image = nil
    if let url = gist.owner?.avatarURL {
      // ...
    }

    return cell
  }

  // ...
}
```

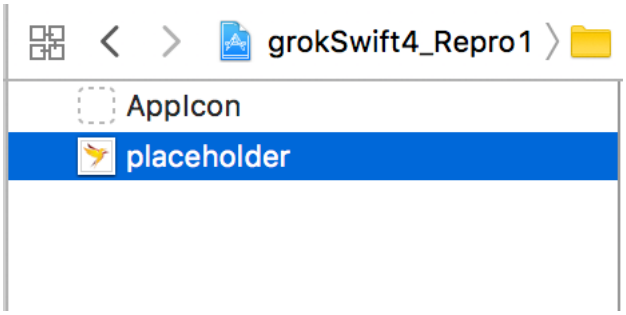
PINRemoteImage works best with a placeholder image. That's also a nice visual touch. So open the `Assets.xcassets` asset library in your project (make sure you have the project organizer selected, it's the first icon on the top-left and looks like a folder):

[3] https://github.com/pinterest/PINRemoteImage



Asset Library

Then rename an image to `placeholder.png` and drag & drop the image into the left panel under the `AppIcon` placeholder.



Add Placeholder Imace

To use `PINRemoteImage` with a `UIImageView`, we call the `pin_SetImage` function and pass in the URL, placeholder image, and a completion hanlder that is called after the image is set. Within the completion handler we can tell the cell it needs to refresh itself using `cellToUpdate.setNeedsLayout()`. We'll display the placeholder for users who don't have an avatar set as well as when we don't have an image loaded yet:

```
override func tableView(_ tableView: UITableView, cellForRowAt indexPath: IndexPath)
  -> UITableViewCell {
  let cell = tableView.dequeueReusableCell(withIdentifier: "Cell", for: indexPath)

  let gist = gists[indexPath.row]
  cell.textLabel?.text = gist.description
  cell.detailTextLabel?.text = gist.owner?.login

  // set cell.imageView to display image at gist.owner?.avatarURL
  if let url = gist.owner?.avatarURL {
    cell.imageView?.pin_setImage(from: url, placeholderImage:
    UIImage(named: "placeholder.png")) {
      result in
      if let cellToUpdate = self.tableView?.cellForRow(at: indexPath) {
        cellToUpdate.setNeedsLayout()
      }
    }
  } else {
    cell.imageView?.image = UIImage(named: "placeholder.png")
  }

  return cell
}
```

9.6 And That's All

Save and run to test that out. You should end up with some avatar images loaded and your placeholder image displayed for those who don't have avatars:

Cell images

If you got tired of typing, here's the code with PINRemoteImage: (tagged "cell_images")[4].

[4] https://github.com/cmoulton/grokSwiftREST_v1.4/releases/tag/cell_images