Safer Swift Code with Value Types

What do I mean by safety?

Medium

View More by This Developer

By A Medium Corporation

Open iTunes to buy and download apps.

View in iTunes

This app is designed for both iPhone and iPad

Description

Welcome to Medium for iOS, a simple app that lets you read and write the stories that matter most to you.

Every day thousands of new voices publish their unique experiences, views, and reflections to Medium.com, creating

A Medium Corporation Web Site Medium Support ...More

What's New in Version 1.14.1121

–Peter let a couple nasty bugs slip into our last release, these have been fixed
–Fired Peter

Agenda

1. **What** are Value Types vs. Reference Types
2. **Why** is this topic relevant now?
3. **How:** A Practical Example of a Value Oriented Architecture

Values vs. References

Reference Types

```
class PersonRefType {
  let name:String
  var age:Int

  // ..
}
// 1
let peter = PersonRefType(name: "Peter", age: 36)
// 2
let peter2 = peter
// 3
peter2.age = 25
// peter {"Peter", 25}
// peter2 {"Peter", 25}
```

Value Types

```
struct Person {
  let name:String
  var age:Int
}
// 1
let petra = Person(name:"Petra", age:25)
// 2
var petra2 = petra
// 3
petra2.age = 20
// petra  {"Petra", 25}
// petra2 {"Petra", 20}
```

Why now?

Foundation / C Types

Reference Types:

- `NSArray`
- `NSSet`
- `NSData`

Value Types:

- `NSInteger`
- `Struct`

Swift Standard Library

Reference Types:

- `ManagedBuffer(?)`
- `NonObjectiveCBase(??)`

Value Types:

- `Array`
- `String`
- `Optional`

Enums and Structs in Swift are Powerful

- Can have properties
- Can have method
- Can conform to protocols

So What Can't They Do?

"Indeed, in contrast to structs, Swift classes support **implementation inheritance**, (limited) reflection, deinitializers, and **multiple owners**."

Andy Matushak[1]

[1] http://www.objc.io/issue-16/swift-classes-vs-structs.html

We've Already Been Doing This!

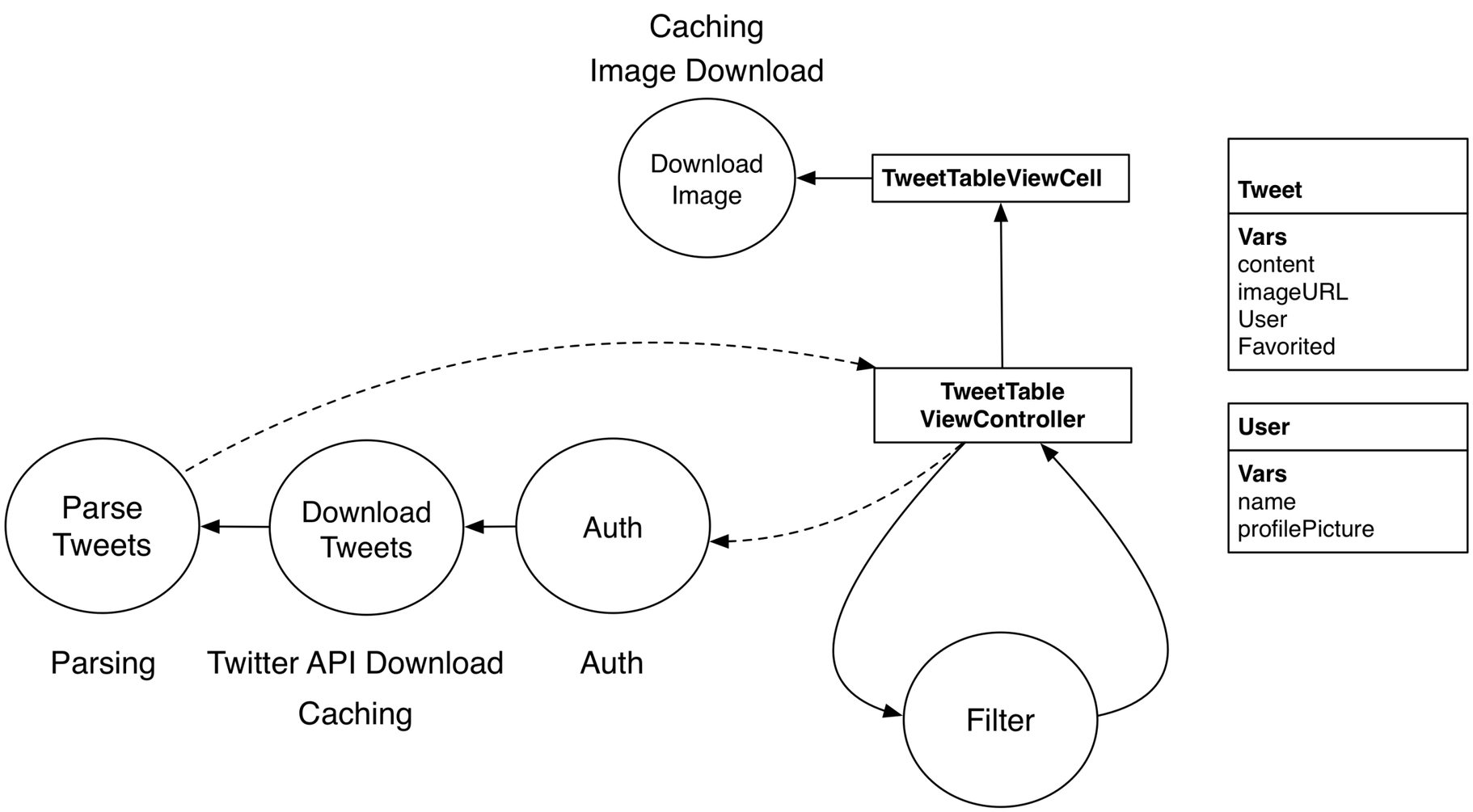
```
@property (copy) NSString *userName;
```

Case Study

A Twitter Client Built on Immutable Value Types

Twitter Client

1. Download the latest 200 tweets and display them
2. Allow to filter tweets (RT only, favorited tweets only, etc.)
3. Allow user to favorite tweets (should be synced with server)


Caching
Image Download
Download Image
TweetTableViewCell
Tweet
Vars
content
imageURL
User
Favorited
TweetTable ViewController
User
Vars
name
profilePicture
Parse Tweets
Download Tweets
Auth
Parsing
Twitter API Download
Caching
Auth
Filter

How can we favorite Tweets?

It Is Very Simple with OOP

```
tweet.favorited = true
```

It Is Simple with OOP

```
let lockQueue = dispatch_queue_create("com.happylocking", nil)
dispatch_sync(lockQueue) {
    tweet.favorited = true
}
```

Is It Simple with OOP?

```
let lockQueue = dispatch_queue_create("com.happylocking", nil)
dispatch_sync(lockQueue) {
    tweet.favorited = true
    NSNotificationCenter.defaultCenter().
        postNotificationName("Tweet Changed", object: tweet)
}
```

Modeling Change is Hard!

```
let lockQueue = dispatch_queue_create("com.happylocking", nil)
dispatch_sync(lockQueue) {
    tweet.favorited = true
    NSNotificationCenter.defaultCenter().
        postNotificationName("Tweet Changed", object: tweet)
    tweetAPIClient.markFavorited(tweet.identifier)
}
```

Modeling Change is Hard!

- Protect against unwanted updates
- Distribute new value throughout application
- Understand what the underlying *identity* of an object is and perform update accordingly

Modeling Change is Hard!

— Protect against unwanted updates
— Distribute new value throughout application
— Understand what the underlying *identity* of an object is and perform update accordingly

-> **We need to this in all places where we mutate values!**

Modelling Change is Hard!

How Can We Model Change With Immutable Value Types?

How Can We Model Change With Immutable Value Types?

Model change to values as values!

How Can We Model Change With Immutable Value Types?

Model change to values as values:

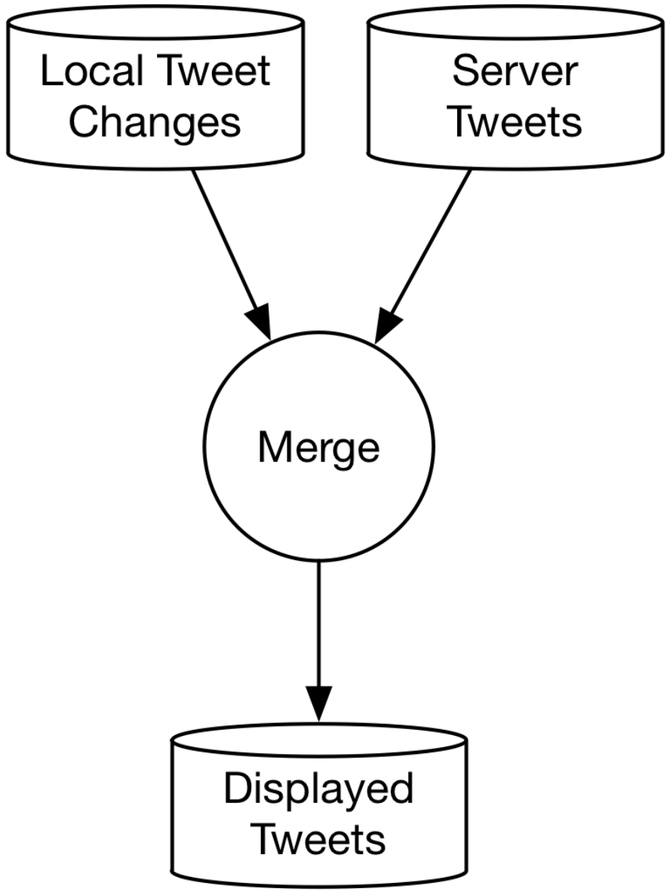
— Create a new Tweet for every change

— Save these changes in a *Store*

— *Store* saves local changes and server state

— *Store* provides a merged view on list of tweets

— *Store* can trigger sync of local state to server


Local Tweet Changes
Server Tweets
Merge
Displayed Tweets

Favoriting a Tweet

```
let currentTweet = tweetTableViewCell.tweet!

let newTweet = Tweet(
  content: currentTweet.content,
  identifier: currentTweet.identifier,
  user: currentTweet.user,
  type: currentTweet.type,
  favoriteCount: currentTweet.favoriteCount,
  isFavorited: !currentTweet.isFavorited
)

store.addTweetChangeToLocalState(newTweet)
```

Modelling Change in Stores

```
class TweetStore {

  var tweets: [Tweet]? {
    get {
        // merge server list and local list
    }
  }

  func addTweetChangeToLocalState(tweet: Tweet) {
    // append tweet to local list
  }

  func loadTweets() -> Promise<[Tweet]> {
    // trigger API request, populate server list
  }
```

Syncing Change

Syncing Change

1. Iterate over each local change
2. Generate API request that syncs that local change to server
3. Upon each API response:
   - If success: remove tweet from local change set
   - If failure: leave tweet in local change set

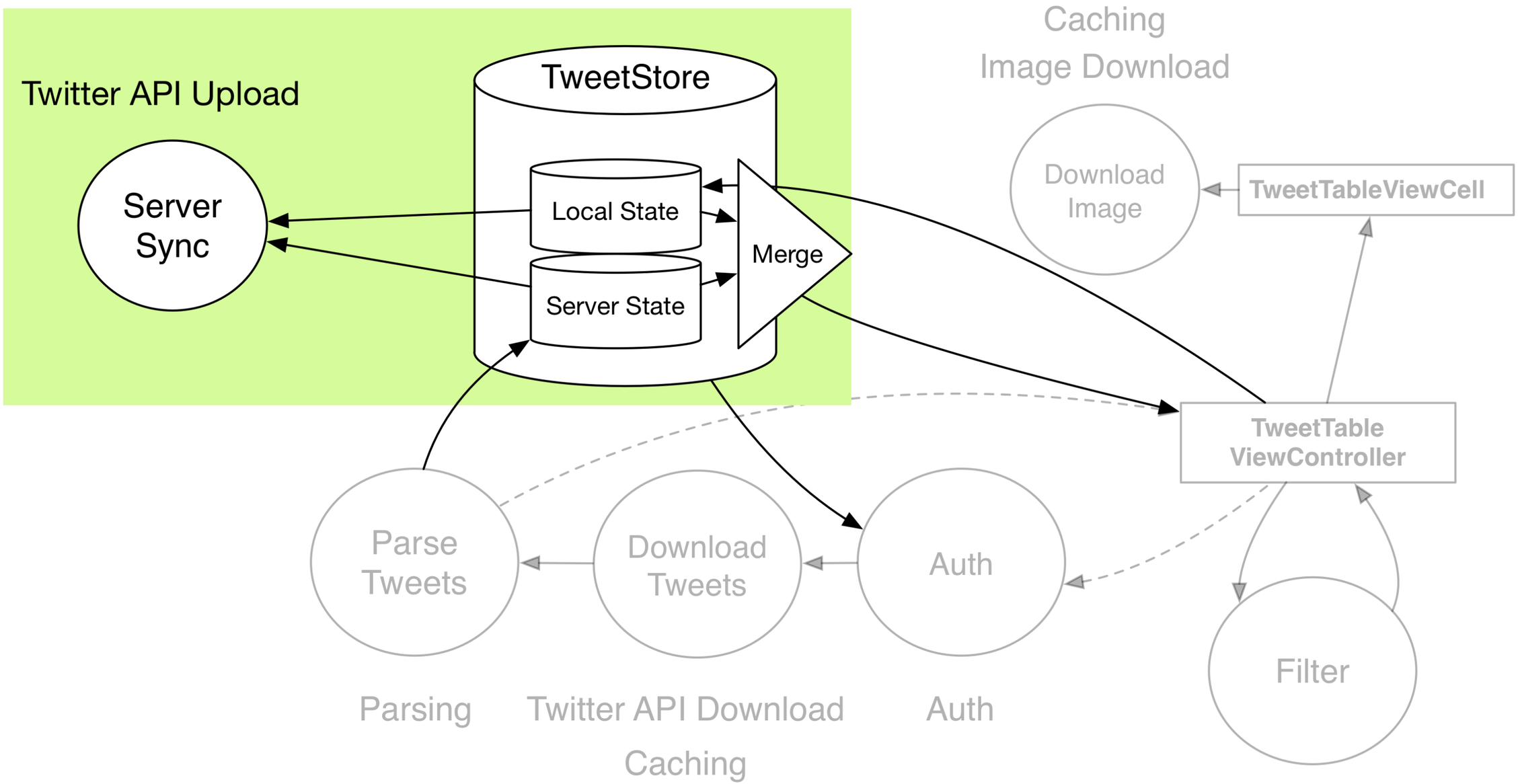
Syncing Change

```
protocol StoreSync {
  typealias StoreType

  static func syncLocalState(merge: StateMerge<StoreType>)
        -> Promise<SyncResult<StoreType>>
}

struct StateMerge <T> {
  let serverState: [T]
  let localState: [T]
}

enum SyncResult <T> {
  case Success(StateMerge<T>)
  case Error(StateMerge<T>)
}
```


Twitter API Upload
TweetStore
Server Sync
Local State
Server State
Merge
Caching
Image Download
Download Image
TweetTableViewCell
TweetTable ViewController
Parse Tweets
Download Tweets
Auth
Filter
Parsing
Twitter API Download
Caching
Auth

Benefits of a Value Oriented Architecture

- Confidence that no one will change our data under the covers
- Change propagation needs to be handled explicitly
- Modeling change as data opens opportunities:
  - Undo Functionality
  - Sophisticated conflict resolution

The Value Mindset

Example project:
https://github.com/Ben-G/TwitterSwift

Related, great talks:
- https://realm.io/news/andy-matuschak-controlling-complexity/
- http://www.infoq.com/presentations/Value-Values