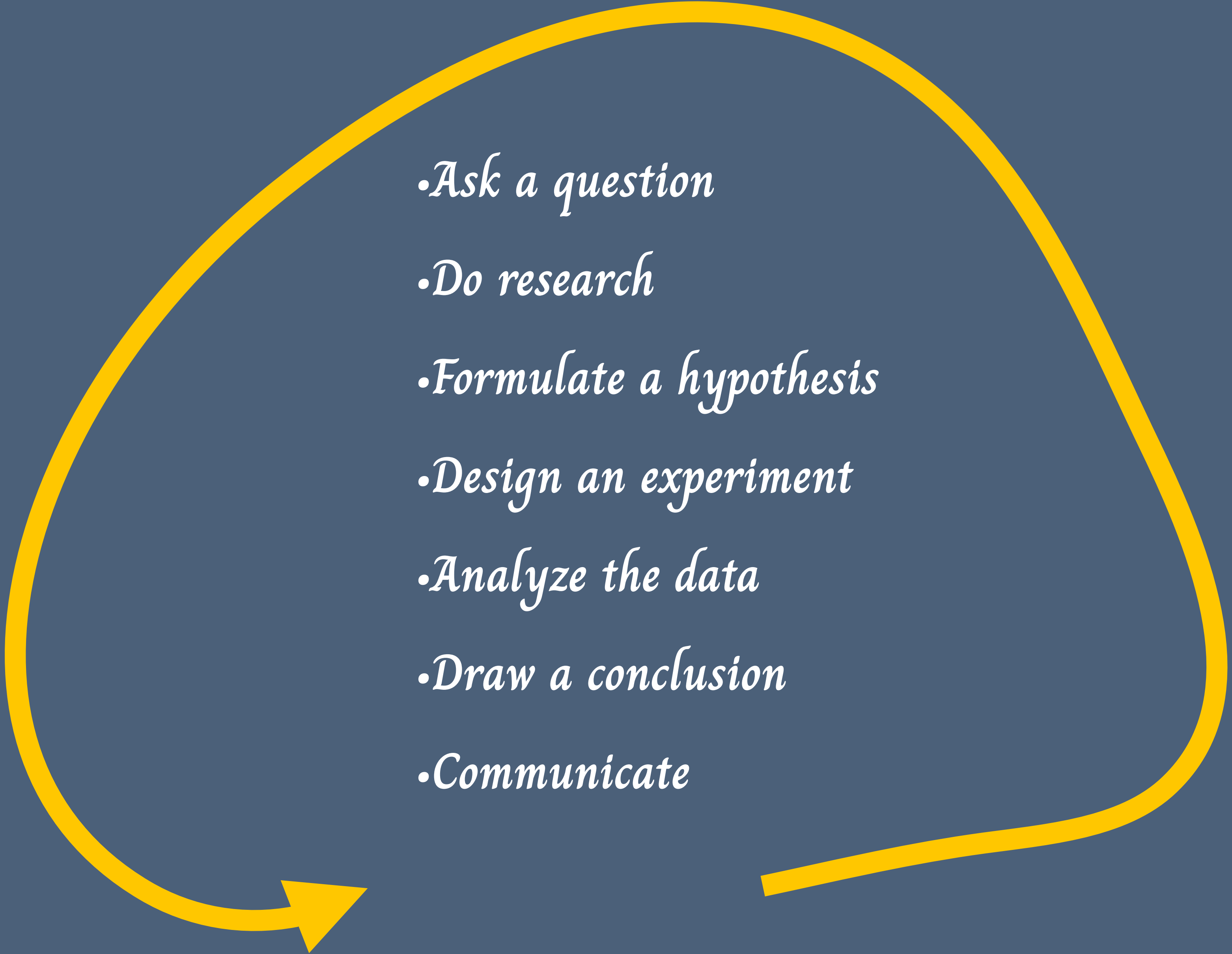


Zen and the Science of Debugging

Programming vs Debugging

Programming is Art

Debugging Is Science

- 
- *Ask a question*
 - *Do research*
 - *Formulate a hypothesis*
 - *Design an experiment*
 - *Analyze the data*
 - *Draw a conclusion*
 - *Communicate*



Rob Napier - @cocoaphony@mastodon.social



@cocoaphony

Periodic Reminder: When debugging, you must first accept that something you believe is true is not true. If everything you believed about this system were true, it would work. It doesn't, so you're wrong about something.

This is a surprisingly common stumbling block for devs.

11:10 AM · Feb 3, 2020

1,690 Reposts **192** Quotes **5,293** Likes **186** Bookmarks



186



What Does The Program
Actually Do?

Before the Bug



Subsystem	Process	Time	Type	Message
com.apple.CoreUtils	rappor	17:01:45.703500-0400		CLink: Peer host state changed: Asleep -> Awake
com.apple.RemoteServiceDisc	remoted	17:01:45.703578-0400		ncmhost-1> Responding to heartbeat request with sequence number 12
com.apple.RemoteServiceDisc	remoted	17:01:45.703600-0400		ncmhost-1> Responding to heartbeat request with sequence number 12
com.apple.siri	assistantd	17:01:45.704550-0400	●	-[ADCompanionService _updateAssistantIDMapForDevice:] unable to find assistant identifier for
com.apple.siri	assistantd	17:01:45.704571-0400	●	-[ADCompanionService _updateAssistantIDMapForDevice:] unable to find assistant identifier for
com.apple.siri	assistantd	17:01:45.704593-0400	●	-[ADCompanionService _updateAssistantIDMapForDevice:] unable to find assistant identifier for
com.apple.siri	assistantd	17:01:45.704528-0400	●	-[ADCompanionService _updateAssistantIDMapForDevice:] unable to find assistant identifier for
com.apple.bluetooth	bluetoothd	17:01:45.706496-0400		Device connected connectCfmCb status 0
com.apple.bluetooth	bluetoothd	17:01:45.706475-0400		Device connected connectCfmCb status 0
com.apple.bluetooth	bluetoothd	17:01:45.706450-0400		Device connected connectCfmCb status 0
com.apple.bluetooth	bluetoothd	17:01:45.706549-0400		Scan Core Classic Connection Event: lm handle: 0x23, BT address: <private>, link type: ACL, E
com.apple.bluetooth	bluetoothd	17:01:45.706680-0400		ACL connected aclConnectCfm for device <private> status 0
com.apple.bluetooth	bluetoothd	17:01:45.706840-0400	●	status 769, h1Cb 0x04E7CB8C
com.apple.bluetooth	bluetoothd	17:01:45.706427-0400		Device connected connectCfmCb status 0
com.apple.calls.callservice	callservicesd	17:01:45.706929-0400		Device changed: <private>
com.apple.bluetooth	bluetoothd	17:01:45.706522-0400		Scan Core Classic Connection Event: lm handle: 0x23, BT address: <private>, link type: ACL, E
com.apple.calls.callservice	callservicesd	17:01:45.707017-0400		Updating nearby device routes using devices: <private>
com.apple.bluetooth	bluetoothd	17:01:45.706649-0400		ACL connected aclConnectCfm for device <private> status 0
com.apple.bluetooth	bluetoothd	17:01:45.706819-0400	●	status 769, h1Cb 0x04E7CB8C
com.apple.calls.callservice	callservicesd	17:01:45.706906-0400		Device changed: <private>
com.apple.calls.callservice	callservicesd	17:01:45.706996-0400		Updating nearby device routes using devices: <private>
com.apple.bluetooth	bluetoothd	17:01:45.706598-0400		Scan Core Classic Connection Event: lm handle: 0x23, BT address: <private>, link type: ACL, E
com.apple.bluetooth	bluetoothd	17:01:45.706573-0400		Scan Core Classic Connection Event: lm handle: 0x23, BT address: <private>, link type: ACL, E

“This old engine has a nickels-and-dimes sound to it. As if there were a lot of loose change flying around inside. Sounds awful, but it’s just normal valve clatter.”

Zen and the Art of Motorcycle Maintenance

Mise en place

It's time to take some notes

My Super-power:
Doing tedious things for a long time

Let go of attachment

You are ignorant,
but this is fixable

Have you actually read the bug
report?

Make sure you're working on the
code you think you're working on.

Make sure you're working on the
object you think you're working on.

“How do you make a statue of an elephant? Get the biggest granite block you can find and chip away everything that doesn't look like an elephant.”

Jane Scott, “Why Are Elephants?”

git bisect

Bisections in Space

Build (Little) Test Apps!

What is this bug were the spec?

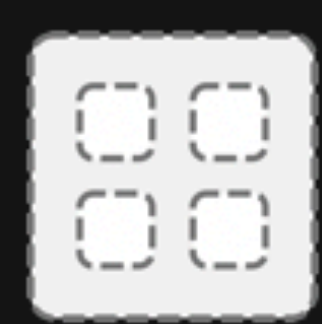
Tests apps can just be tests.

Experiment...a lot.

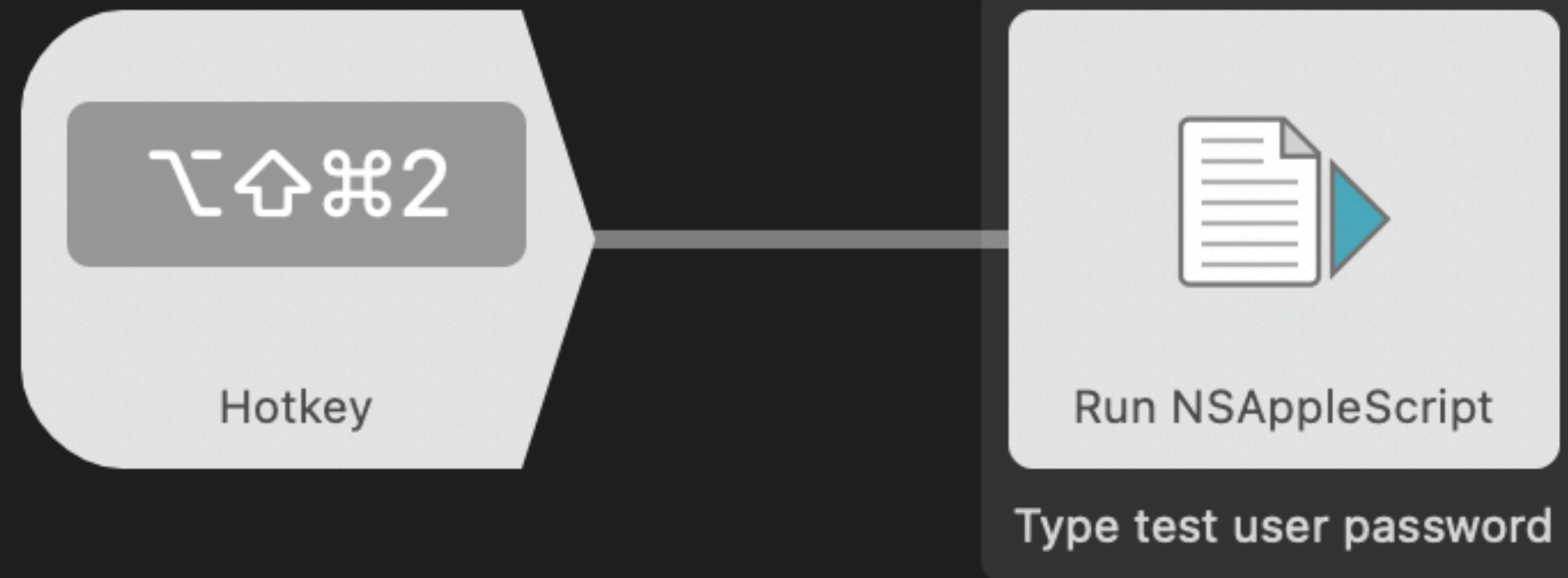
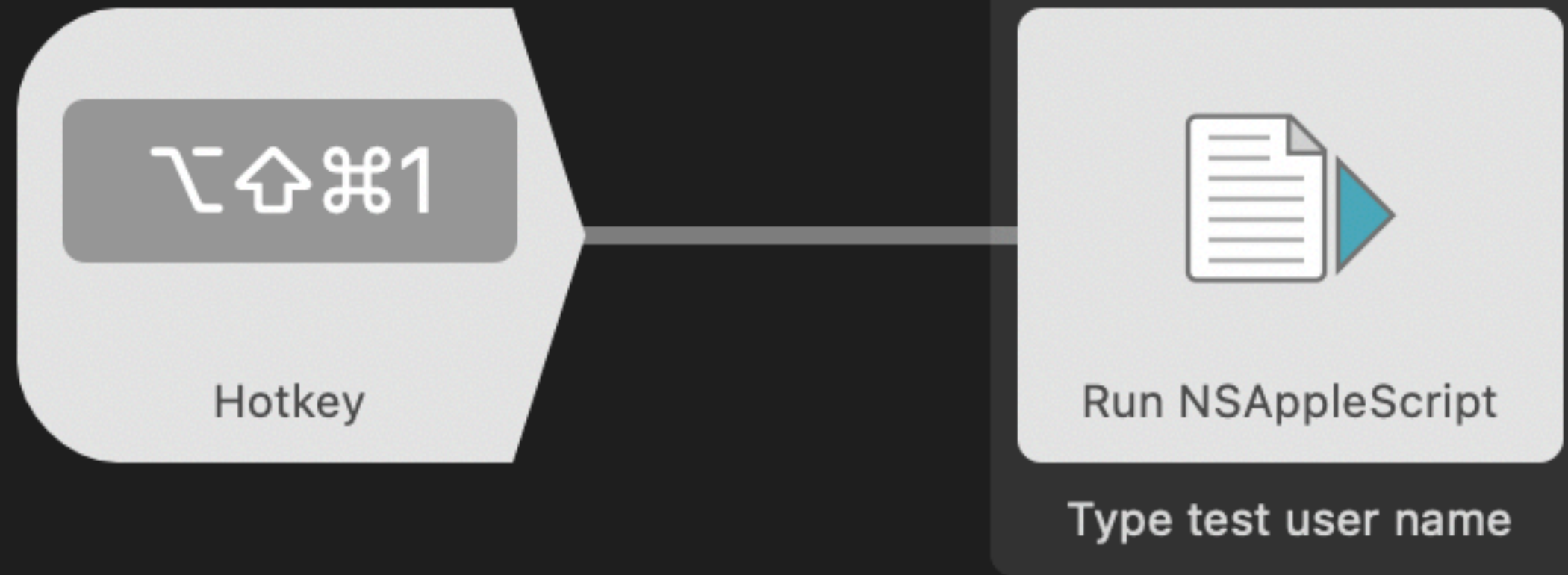
Now is not the time.

You do not need to spend 6 hours
learning a testing framework now.

The power of semi-automatic



Testing Hotkeys



Please note that this action uses NSAppleScript and blocks Alfred's main thread.
In general, try using the Run Script action with /usr/bin/osascript (AppleScript) instead.

AppleScript:

```
on alfred_script(q)
    tell application "System Events"
        keystroke "rob+test@example.com\t"
    end tell
end alfred_script
```

Wrap scripts in on alfred_script(q) handler. Use 'Cache compiled script' for fastest possible performance but more memory usage.

☒ Cache compiled AppleScript



Cancel

Save

```
xcrun simctl uninstall booted <bundle>
```

```
cd $(xcrun simctl get_app_container booted <bundle> data)
```


Hitting the bullseye

```
func collision(count: Int) async {
    class C { var s: String = "" }

    let c = C()

    await withTaskGroup(of: Void.self) { group in
        for _ in 0..
```

```
extension Duration {  
    static func randomSeconds(lessThan: Int) -> Self {  
        seconds((0..  
lessThan).randomElement()!)  
    }  
}  
  
Task {  
    someSyncWork()  
    otherSyncWork()  
  
    await asyncWork()  
    // Sleep after each await before moving on  
    try await Task.sleep(for: .randomSeconds(lessThan: 10))  
  
    someMoreSyncWork()  
}
```

Your users have terrible
networks.

[Back](#) Network Link Conditioner

Enable



CHOOSE A PROFILE...

- ✓

100% Loss
Preset

>
- 3G**
Preset

>
- DSL**
Preset

>
- Edge**
Preset

>
- High Latency DNS**
Preset

>
- LTE**
Preset

>
- Very Bad Network**
Preset

>
- Wi-Fi**
Preset

>
- Wi-Fi 802.11ac**
Preset

>

Add a profile...

Re-attachment

Go back to the journal.

Root causing


```
func updateRecord(at index: Int) {  
    records[index].lastChanged = .now  
}
```

```
func updateRecord(at index: Int) {  
    guard records.indices.contains(index) else { return }  
    records[index].lastChanged = .now  
}
```

Please don't do that.

There are worse things than
crashing.



There was an old lady who swallowed a fly,
I don't know why she swallowed a fly – perhaps she'll die!

There was an old lady who swallowed a spider
That wriggled and jiggled and tickled inside her;
She swallowed the spider to catch the fly;
I don't know why she swallowed a fly – perhaps she'll die!

There was an old lady who swallowed a bird;
How absurd to swallow a bird!
She swallowed the bird to catch the spider
That wriggled and jiggled and tickled inside her,
She swallowed the spider to catch the fly;
I don't know why she swallowed a fly – perhaps she'll die!

There was an old lady who swallowed a cat;
Well, fancy that, she swallowed a cat!

You need to find the real bug.

I get it.

Quick fixes are not “band-aids.”

Quick fixes are not “band-aids.”
They’re whiskey.

Letting go and cleaning up

```
func updateRecord(at index: Int) {  
    // FIXME: This `guard` is a hacked work-around for Issue #498.  
    // In some cases the index is out of range. We have never reproduced  
    // this and do not know if `records` is empty or `index` is just  
    // unexpected. It appears to happen most often, but not exclusively,  
    // to users who have recently upgraded from the v6 schema. See the  
    // above issue for details on things that have been explored.  
    // -- rnapier 2024-08-30  
    guard records.indices.contains(index) else {  
        assertionFailure("You've reproduced #498! Please contact rnapier.")  
        return  
    }  
  
    records[index].lastChanged = .now  
}
```



// Workaround Apple bug

```
// Workaround Apple bug in iOS 15 (FBxxxxxxx) where ...  
//  
// This works around that issue by ...  
// See https://developer.apple.com/forums/...  
//  
// The bug is fixed in iOS 17. When we drop iOS 15 support,  
// this can be replaced with:  
//  
//     ...  
//  
// -- rnapier 2023-08-20
```

Back down from the mountain

Not everyone understands what a completely rational process this is, this maintenance of a motorcycle. They think it's some kind of a "knack" or some kind of "affinity for machines" in operation.

They are right, but the knack is almost purely a process of reason, and most of the troubles are caused by what old time radio men called a "short between the earphones," failures to use the head properly.

Zen and the Art of Motorcycle Maintenance

Rob Napier — @cocoaphony@mastodon.social — robnapier.net