(Game) Hacking with Frida.re

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How do CTF exploits usually look like?

```python
from pwn import *
r = remote('ctf.kitctf.de', 1337)

# ...

r.sendline(b'A' * cyclic_find('kaan') + rop.chain())
r.interactive()
```

What if the target is more complex

- (Multiplayer) games
  - Server-side messages we need to respond to
  - Traffic encryption & obfuscation
- Messenger applications
  - Whatsapp, iMessage, Zoom
  - E2E encryption, custom protocols
- Mobile apps
  - Hard to debug using regular debuggers
  - May only run on physical devices

Frida to the rescue

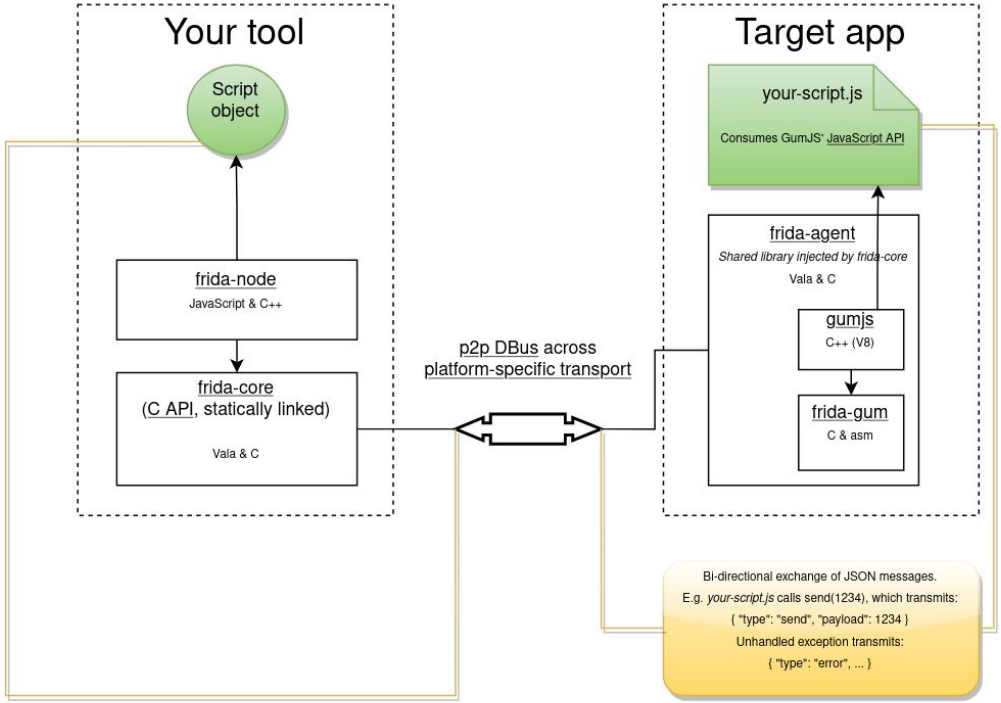
- Dynamic analysis + easy patching
- Instrument the real client for a service
  - Abuse communication routines
- Run our exploit script directly on a device
  - eg. Whatsapp exploit runs within a modified Whatsapp client
- Just for exploits?
  - No, also useful for dynamic analysis

What is Frida?

> “Dynamic instrumentation toolkit for developers, reverse-engineers, and security researchers.”

- A framework for reverse-engineering tools
- A debugger with a really nice typescript API
- A way to inject custom javascript “agents” into processes
  - Greasemonkey for native apps
- Supports various platforms
  - Windows, macOS,Linux, iOS, watchOS, tvOS, Android, FreeBSD, and QNX

How does it work?



How does it look like?

```
const base = Module.getBaseAddress('craft')
const yPos = base.add(0x273c24)
const rot = yPos.add(12)

Interceptor.attach(Module.getExportByName(null, 'handle_movement'), {
    onEnter() {
        this.preY = yPos.readFloat()
    },
    onLeave() {
        if (flying) {
            yPos.writeFloat(this.preY + rot.readFloat() * .2)
        }
    }
})
```

Use Case – Mobile security

- Simple real-world problem: certificate pinning in Android
  - < 10 line script - 90% of my frida usage

```
Java.perform(function() {
    var array_list = Java.use("java.util.ArrayList");
    var ApiClient = Java.use('com.android.org.conscrypt.TrustManagerImpl');

    ApiClient.checkTrustedRecursive.implementation = function(a1, a2, a3, a4, a5, a6) {
        var k = array_list.$new();
        return k;
    }
}, 0);
```

Hooking android crypto APIs

- com.android.org.conscrypt.TrustManagerImpl.checkTrustedRecursive
  - Recursively build certificate chains until a valid chain is found or all possible paths are exhausted.
  - return the entire valid chain starting with the leaf certificate. This is the concatenation of untrustedChain and trustAnchorChain.
  - throws CertificateException If no valid chain could be constructed. [...]

https://github.com/google/conscrypt/blob/master/common/src/main/java/org/conscrypt/TrustManagerImpl.java#L521

Debugging on a phone???

```
$ adb push frida-server-* /data/local/tmp/frida-server
$ adb shell /data/local/tmp/frida-server &
$ frida --codeshare sowdust/universal-android-ssl-pinning-bypass-2 -U -F --no-pause
```

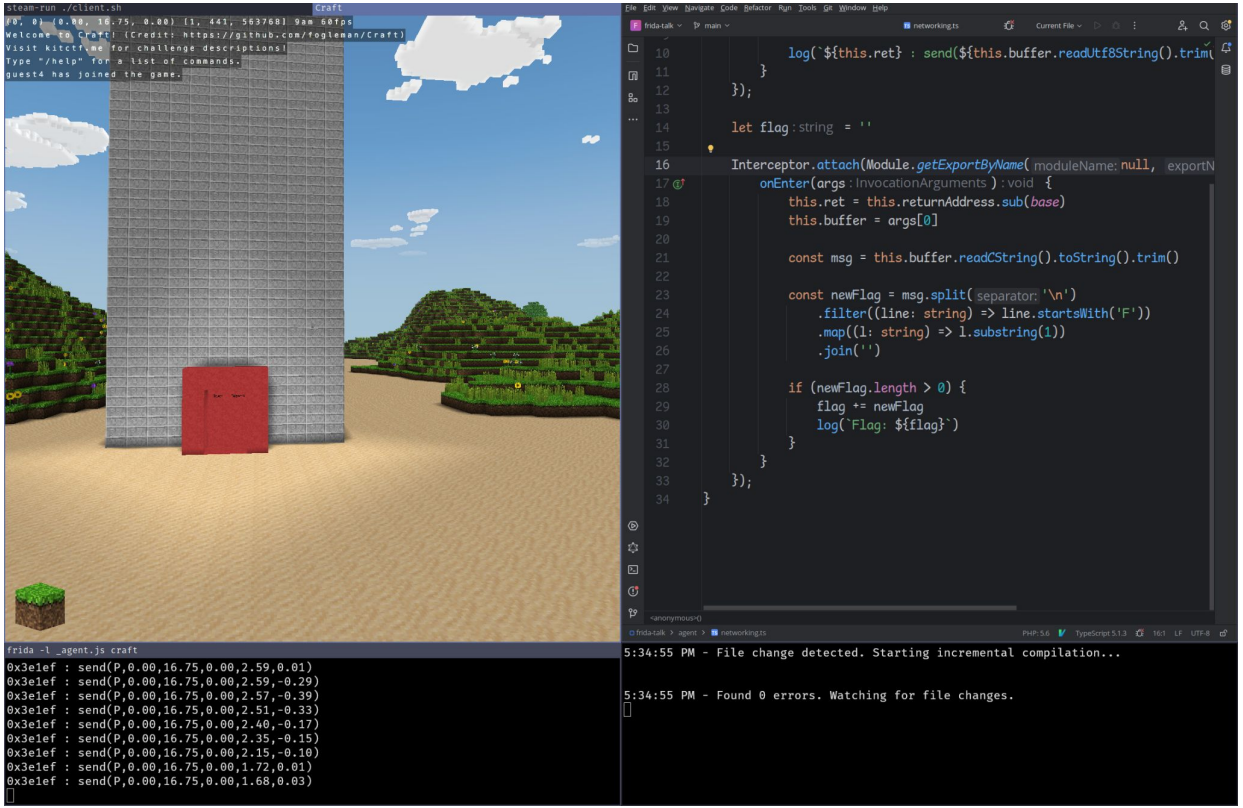
Use Case – Mobile security

- Inject code into real world application
  - Stdlib provides access to high level languages like Java, Swift, Objective-C
- Easy to run frida on mobile devices
  - Root is helpful but often not needed
  - Emulators work as well
- Hooking a single function in a complex lib is something frida is perfect for

Demo – Game Hacking

- “Craft” challenges from KITCTF internal CTF 2022 - by ju256
  - Source was provided during CTF, we ignore this for now
- Networking
  - Analyzing the network traffic of a game is always a good place to start. So, here you go...
- Broken Wings
  - If you get them back you should checkout the clouds. I'm pretty sure there is something hidden there.
- Treasury
  - Use the teleport in the tower to get to the treasury.

Demo – Game Hacking



Demo – Recap

- Interceptor API
  - Attach: breakpoints / logpoints
  - Replace: replace function with our own implementation
- Memory & Module APIs
  - Get runtime offsets
  - Read & write arbitrary memory
- NativeFunctions
  - Call existing native functions from our agent
- Stalker
  - Trace applications

What else is there to know?

- CModules
  - If we have a hot function in our agent we can just throw some inline C at it
- Modes of operations
  - Frida gadget can be LD_PRELOADed to run from the start of the programm
- For Unity challenges: il2cpp offsets
  - Unity can compile .net IL to cpp
  - Tools can extract method names + offsets
  - Perfect starting point for some Frida hooks
- Frida for fuzzing
  - AFL++ can use frida instead of qemu for fuzzing
  - Some tools exist for in-process fuzzing, attaching a fuzzer to a running application
- Control scripts
  - Manage how your agent runs using a script outside of the target process

Hands on challenges

- Gamehacking
  - Craft challenges
  - CSRunner (unity, offline) from Rumble 2021
- Android
  - Click me from NahamCon 2022
  - Secure Notes, same event
- Links in Slack
  - https://mawalabs.de/stuff/csrunner.tar.gz
  - https://mawalabs.de/stuff/frida.tar.gz

Learning resources

- https://learnfrida.info/
- https://frida.re/docs/javascript-api/
- https://github.com/dweinstein/awesome-frida
    - Lots of awesome tools. Mileage may vary but often a good source for example code.

How can I use it

- Install Frida
- Write agent script
- Attach to process
  - Can be on external device or run locally
- ???
- Profit
  - Knowledge
  - Working exploits
  - 100.000 HP