Puppeteer for Evil Minds

ANTISNATCHOR

Outline

- The need of automation
- Puppeteer fundamentals
- Automating Recon and Phishing
- Puppeteer for WebSecurity?
- Puppeteer detection
- The future

The need of automation

- Many different contexts benefits from automation:
  - Reconnaissance
  - Phishing
  - Advanced simulations
  - Functional and Web Security testing

The need of automation: recon

- Searching and scraping info from web portals without relying on APIs (no rate limits, flexibility)
- Perform programmatic actions via fake profiles in a very realistic way
- Monitor hourly for content changes on social networks and web portals in general

The need of automation: phishing

- The more targets, the more sessions you collect: doing manual work on the hijacked session rarely make sense, even in spear phishing scenarios
- Setting the victim's Cookies on a Chrome headless instance that:
  - add your SSH key to the target repository;
  - or add an Application Password to the profile;
  - Or dumps the contact list and send a dropper to all the marketing team?

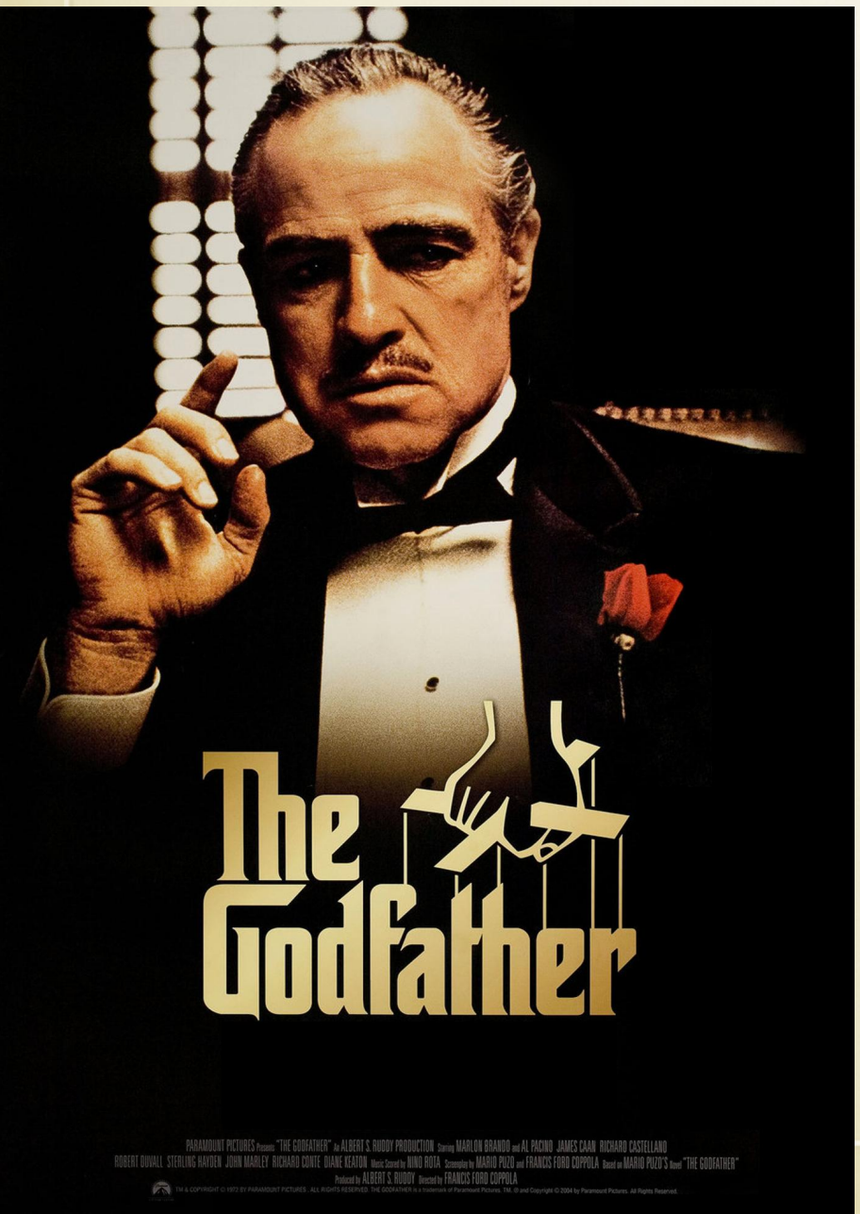
The need of automation: advanced simulations

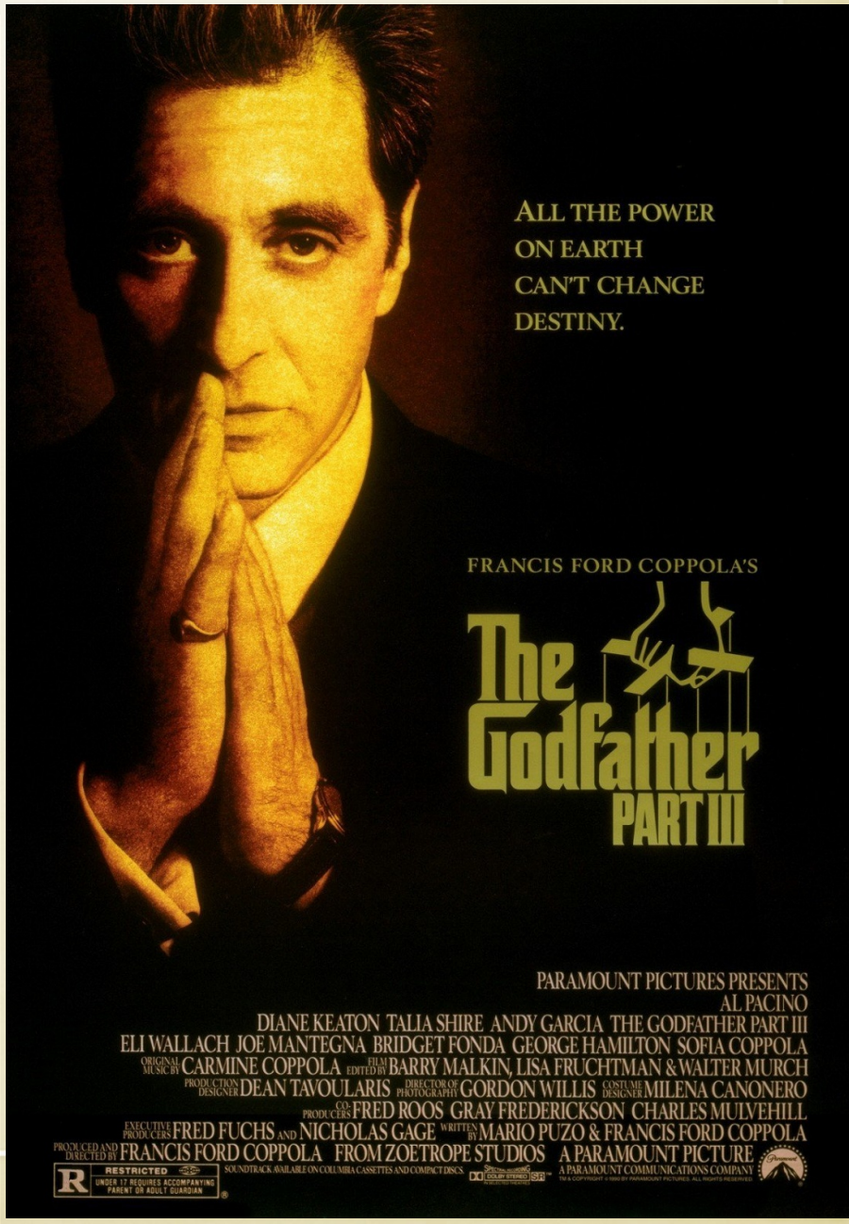
- Simulating N browsers that do N actions from N IPs, each of them with different fingerprint
- Automating complex web workflows that are harder to do without a browser

The need of automation: testing & web security

- Where Burp Macros are not enough, browser automation comes to the rescue
- Ex.: bugs or chains that need:
  - drag&drop or other mouse events
  - Weird JS apps and other browser detections

Google's Puppeteer &&& Coppola's Padrino





Puppeteer

- Browser Automation Library bridging Chrome and NodeJS through CDP (Chrome DevTools Protocol)
- Created by Google to work on Google browser
  - *Modern Web Testing and Automation with Puppeteer (Google I/O '19)* by Andrey Lushnikov & Joel Einbinder: https://www.youtube.com/watch?v=MbnATLCuKI4

Puppeteer

- Allows you to programmatically tell the browser, in GUI or headless mode, to do all the things
- Set cookies, fill form inputs, click buttons
- Reliably wait for elements and control the DOM
- Achieve parallelism with multiple browser tabs

Puppeteer

- Chrome DevTools Protocol is the key
  - Fast and reliable over WebSockets
    - Also used by Chrome Inspect View to inspect and control the DOM dynamically
- 1. chrome --remote-debugging-port=9222
- 2. chrome --user-data-dir=<dir>
- 3. browse to http://localhost:9222

Puppeteer

- From a sane NodeJS environment: npm install puppeteer

- There is **experimental support** for **Firefox**: npm install puppeteer-firebox

- https://aslushnikov.github.io/ispuppeteerfirefoxready/

- Tests Passing: **82%** (517/632)
- Supported API: **89%** (222/249)
- Last updated: **71 days ago**

Puppeteer API

- class: Page
  - event: 'close'
  - event: 'console'
  - event: 'dialog'
  - event: 'domcontentloaded'
  - event: 'error'
  - event: 'frameattached'
  - event: 'framedetached'
  - event: 'framenavigated'
  - event: 'load'
  - event: 'metrics'
  - event: 'pageerror'
  - event: 'popup'
  - event: 'request'
  - event: 'requestfailed'
  - event: 'requestfinished'
  - event: 'response'
  - event: 'workercreated'
  - event: 'workerdestroyed'
  - page.$(selector)
  - page.$$(selector)
  - page.$$eval(selector, pageFunction[, ...args])
  - page.$eval(selector, pageFunction[, ...args])
  - page.$x(expression)
  - page.accessibility
  - page.addScriptTag(options)
  - page.addStyleTag(options)
  - page.authenticate(credentials)
  - page.bringToFront()
  - page.browser()
  - page.browserContext()
  - page.click(selector[, options])
  - page.close([options])
  - page.content()
  - page.cookies([...urls])
  - page.coverage
  - page.deleteCookie(...cookies)
  - page.emulate(options)
  - page.emulateMedia(type)
  - page.emulateMediaFeatures(features)
  - page.emulateMediaType(type)
  - page.emulateTimezone(timezoneId)
  - page.evaluate(pageFunction[, ...args])
  - page.evaluateHandle(pageFunction[, ...args])
  - page.evaluateOnNewDocument(pageFunction[, ...args])
  - page.exposeFunction(name, puppeteerFunction)
  - page.focus(selector)
  - page.frames()
  - page.goBack([options])
  - page.goForward([options])
  - page.goto(url[, options])
  - page.hover(selector)
  - page.isClosed()
  - page.keyboard
  - page.mainFrame()
  - page.metrics()
  - page.mouse
  - page.pdf([options])
  - page.queryObjects(prototypeHandle)
  - page.reload([options])
  - page.screenshot([options])
  - page.select(selector, ...values)
  - page.setBypassCSP(enabled)
  - page.setCacheEnabled([enabled])
  - page.setContent(html[, options])
  - page.setCookie(...cookies)
  - page.setDefaultNavigationTimeout(timeout)
  - page.setDefaultTimeout(timeout)
- class: Accessibility
  - accessibility.snapshot([options])
- class: Keyboard
  - keyboard.down(key[, options])
  - keyboard.press(key[, options])
  - keyboard.sendCharacter(char)
  - keyboard.type(text[, options])
  - keyboard.up(key)
- class: Mouse
  - mouse.click(x, y[, options])
  - mouse.down([options])
  - mouse.move(x, y[, options])
  - mouse.up([options])
- class: Touchscreen
  - touchscreen.tap(x, y)
- class: Tracing
  - tracing.start([options])
  - tracing.stop()
- class: FileChooser
  - fileChooser.accept(filePaths)
  - fileChooser.cancel()
  - fileChooser.isMultiple()
- class: Dialog
  - dialog.accept([promptText])
  - dialog.defaultValue()
  - dialog.dismiss()
  - dialog.message()
  - dialog.type()
- class: ConsoleMessage
  - consoleMessage.args()
  - consoleMessage.location()

Puppeteer API

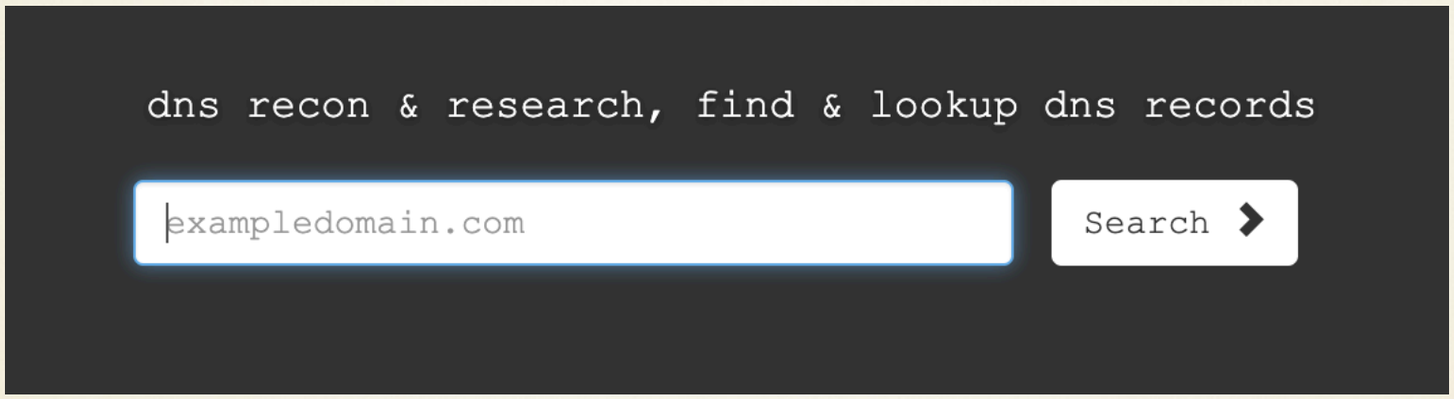
```
page.$(selector)
page.$$(selector)
page.$$eval(selector, pageFunction[, ...args])
page.$eval(selector, pageFunction[, ...args])
page.$x(expression)
```

- Selector is the CSS selector
- **$** == document.querySelector
- **$$** == document.querySelectorAll
- **$eval/$$eval** == as above but passing the result to the pageFunction
- **$x** == Xpath expression

Puppeteer API

- Most of the API calls expect CSS selectors
- Convenient calls to emulate:
- Mobile devices (see https://github.com/GoogleChrome/puppeteer/blob/master/lib/DeviceDescriptors.js)
- Media features, types
- Timezone and Geolocation

Puppeteer for recon



- DnsDumpster.com is a great resource, but no API
- Puppeteer to the rescue to scrape subdomains, and screenshot those that are reachable via HTTP(S)
- Parallelism achieved opening each FQDN in its own tab

Puppeteer for recon

```
const puppeteer = require('puppeteer');
const target = "alitalia.it";
const headless = true;
const pageTimeout = 60000;

(async () => {
   const browser = await puppeteer.launch({
       headless: headless,
    });
  const page = await browser.newPage()

  const navigationPromise = page.waitForNavigation()

  await page.goto('https://dnsdumpster.com/')

  await page.setViewport({ width: 1920, height: 900 })

  await page.waitForSelector('#hideform #regularInput')
  await page.click('#hideform #regularInput')

  await page.keyboard.type(target, {delay: 100}); // Types slower, like a user

  await page.waitForSelector('.inner > #hideform > form > #formsubmit > .btn')
  await page.click('.inner > #hideform > form > #formsubmit > .btn')

  // wait for results
  console.log("Waiting for results to come up...")
  await page.waitForSelector('#intro > div:nth-child(1) > div.row > div > h4')
  await navigationPromise
```

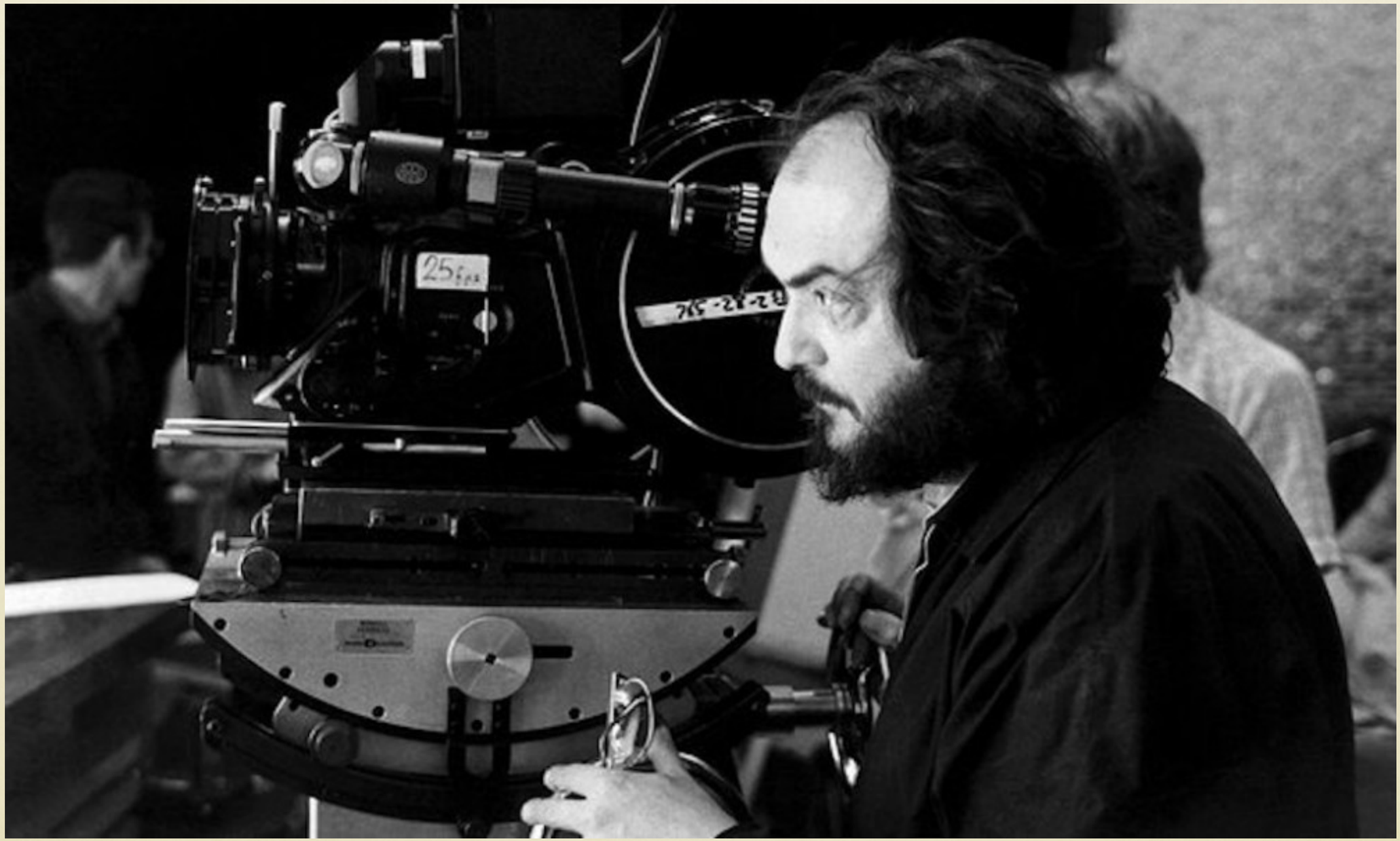
Puppeteer for recon

```
// gets all tables in results
const tables = await page.$$('#intro > div:nth-child(1) > div.row > div table');

const txtRecords = await tables[2].$$eval('tr td', tds => tds.map((td) => {
    return td.innerText + "\n";
}));

let hosts = await tables[3].$$eval('tr td:nth-child(1)', tds => tds.map((td) => {
    let fqdn = td.innerHTML.split("<br>")[0]
    return fqdn;
}));
hosts = hosts.sort();
hosts.forEach(function(host){
    console.log(host);
});
```

```
const promises=[];
  hosts.forEach(function(host){
    // open each host in its own tab
    promises.push(browser.newPage().then(async page => {
     try {
        await page.goto("https://" + host, {
          waitFor: 'networkidle2',  timeout: pageTimeout,
           ignoreHTTPSErrors: true
        });
        await page.screenshot({path: `screenshots/https--${host}.png`});
      }catch(e){}
    }));
  });

  // wait for all tabs to close
  await Promise.all(promises);
  await browser.close()
})()
```

Puppeteer for recon

Let's see it in action!



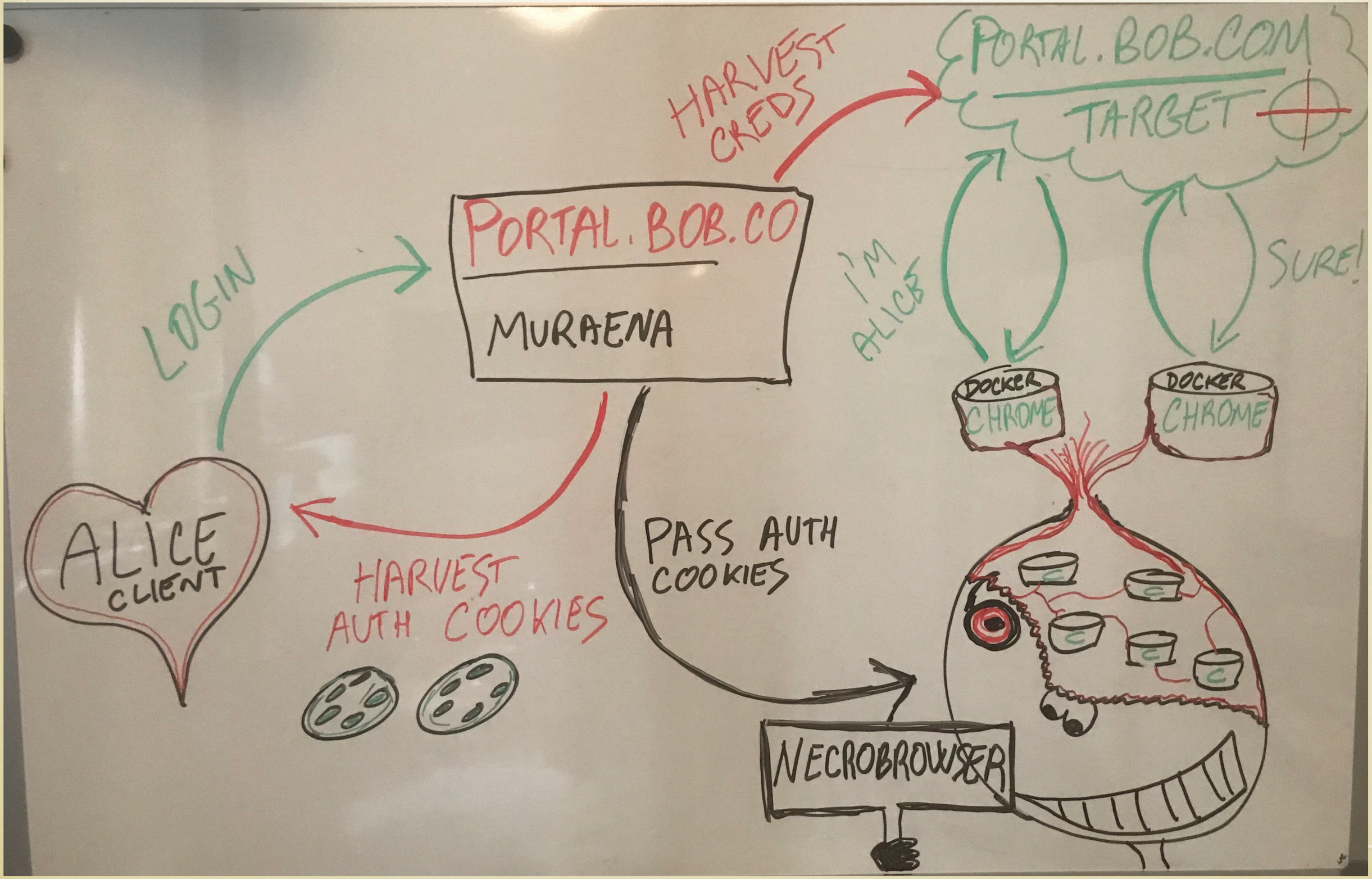
Puppeteer for phishing

- Modern Phishing involves a reverse proxy solution (hint: Muraena)
- A smart reverse proxy can then be used to:
- **intercept** all the traffic
- **fulfil the 2FA requests flow**
- pass post-2FA login session cookies to an **instrumented browser that hijacks** the victim's session

Puppeteer for phishing

- Since all the traffic is passing through **Muraena**, credentials and session cookies are captured
- Is the targeted origin **able to detect if we hijack** the authenticated session passing it to an instrumented browser?
  - Usually **NO**, plus:
    - the instrumented browser connection goes out via the same IP of the proxy via IPSEC,
    - the UA is changed to reflect the victim one.

Puppeteer for phishing



Puppeteer for phishing

- **NecroBrowser** is a Go wrapper around **chromedp** (https://github.com/chromedp/chromedp)
  - Programmatically drive Chrome via Chrome DevTools Protocol (CDP), like Puppeteer
  - Exposed as a micro service that spawns dedicated Docker containers with Chrome headless
  - Allows to keep alive as many session as your Docker server/cluster can support

Puppeteer for phishing

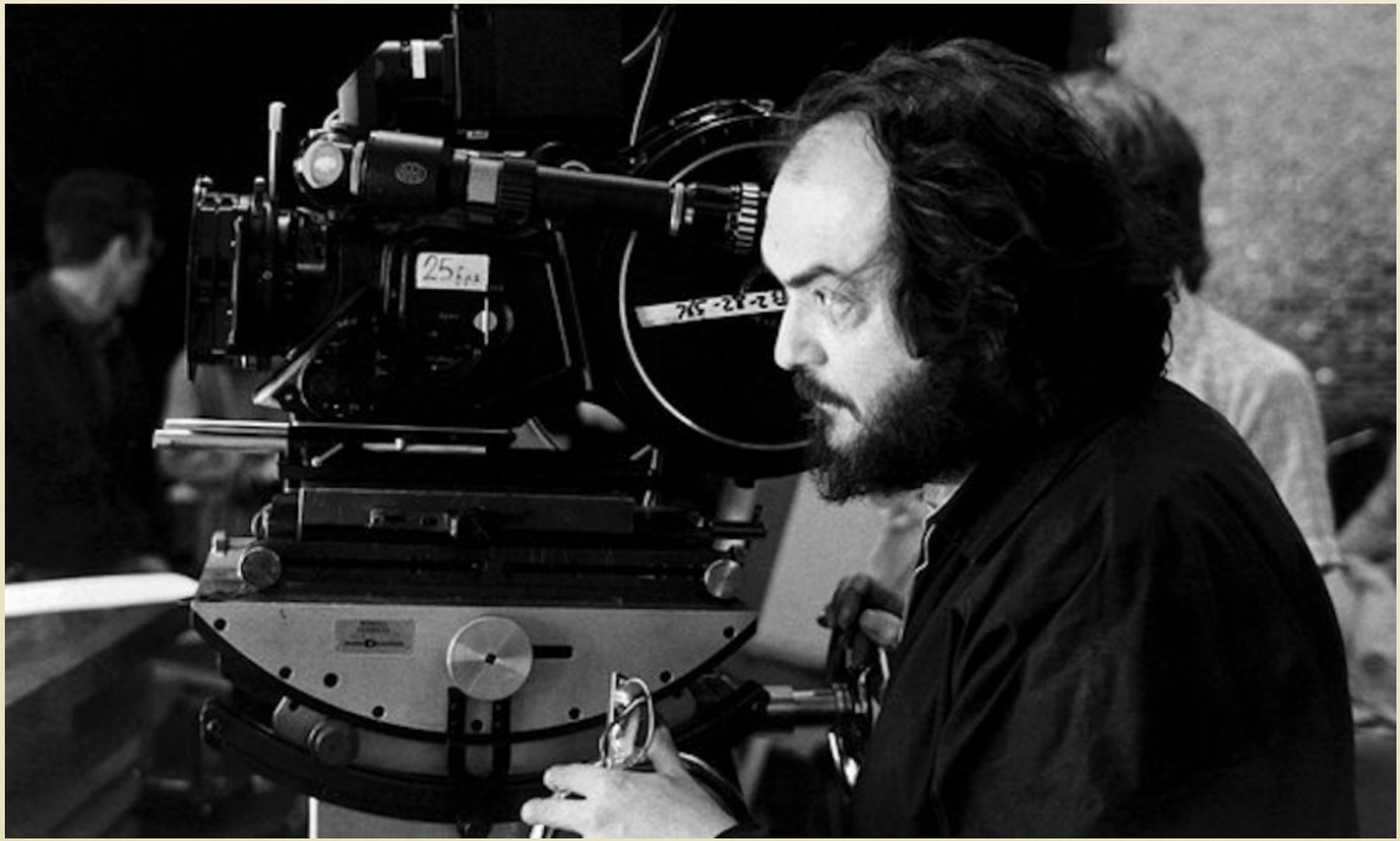
- The problems of **chromedp:**
  - Unreliable on certain complex pages, especially in headless mode (GSuite, Office365)
    - Sometimes events are not triggered, plus other subtle bugs hard to debug
- Not updated/maintained like Puppeteer

Puppeteer for phishing

- Plan is to **replace chromedp with Puppeteer** in **NecroBrowser**
- No need for Docker containers anymore
- Faster and more reliable
- ETA Christmas 2019

Muraena and necrobrowser

Let's see it in action!



Puppeteer for phishing

Get Muraena and NecroBrowser here:

https://github.com/muraenateam

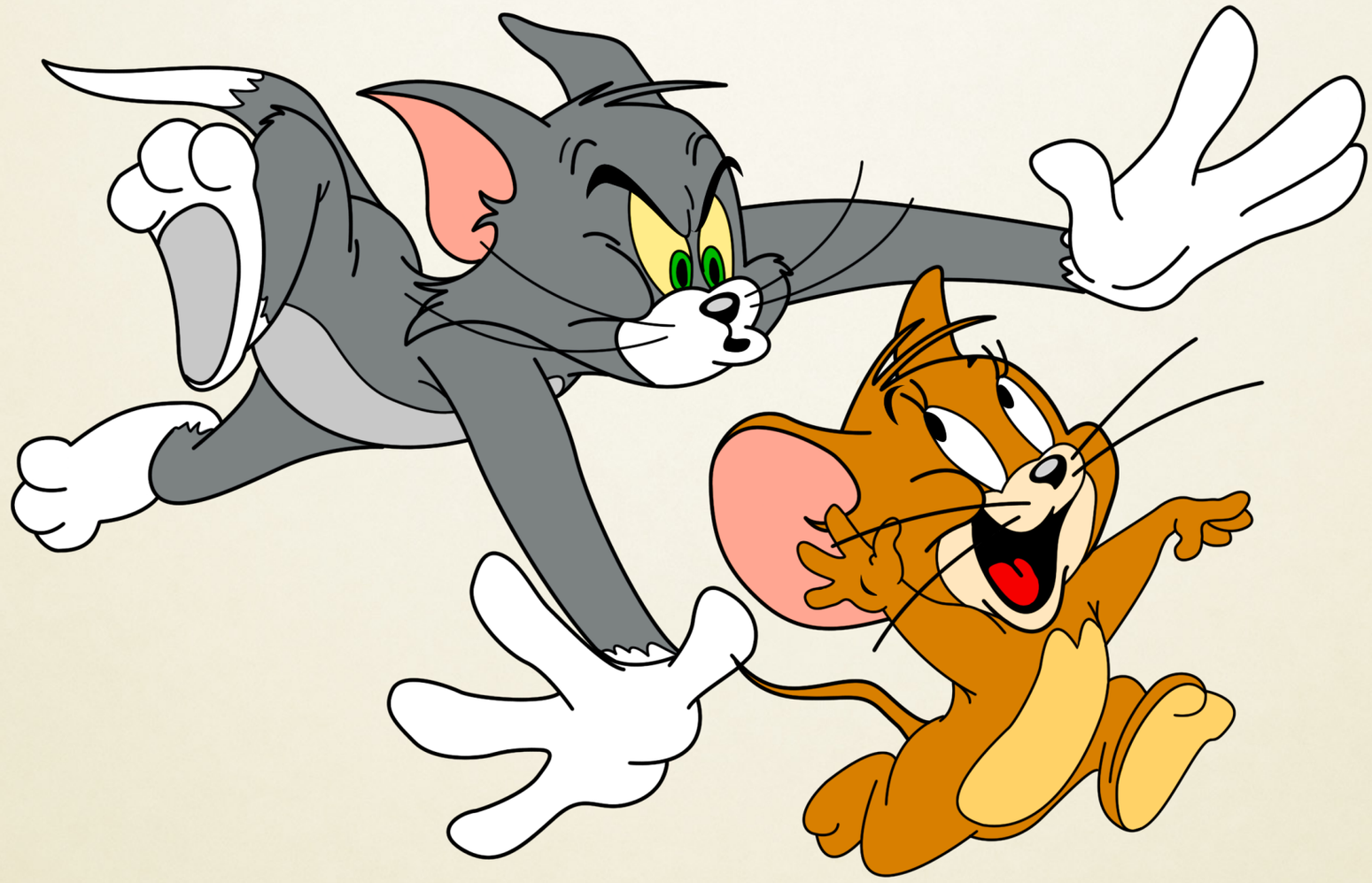
Puppeteer for web security

- Automatically test to check if an application is still vulnerable to a certain bug
  - XSS: trigger and grep DOM or wait for callback
  - SQLi: trigger and grep errors/status codes/ timing
  - RCE: trigger and check
  - SSRF & al.: trigger and check

Puppeteer for web security

- Integrate Puppeteer in Continuous Integration Security Tests
  - Port the attack vectors to Puppeteer scripts
  - Use them in your Functional tests, simulating different devices
  - …
  - Not much websecurity ideas here sorry OWASP!

Puppeteer detection?



Current status:

```
Headless detection *failed*.
😎   Evaders are winning!
```

Puppeteer detection

- https://intoli.com/blog/making-chrome-headless-undetectable/
- https://intoli.com/blog/not-possible-to-block-chrome-headless/
- Simply, it's not easy to detect a non-human driven browser

Test Name		Result
User Agent	(Old)	Mozilla/5.0 (X11; Linux x86_64)AppleWebKit/537.36 (KHTML, like Gecko) Chrome/64.0.3282.39 Safari/537.36
WebDriver	(New)	missing (passed)
Chrome	(New)	present (passed)
Permissions	(New)	pending
Plugins Length	(Old)	5
Languages	(Old)	en-US,en

The future

- Integrate Puppeteer in NecroBrowser
  - ETA Christmas 2019