Life as a pentester

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- Cybersecurity and its impact
- Pentesting: Goals, stages and reality
- Kind of pentests
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Cybersecurity and its impact

Quick basics

- **Confidentiality**: Only authorized parties should see the information.
- **Integrity**: Information is stored/sent as it is, no unauthorized modifications.
- **Availability**: Access the information anytime

Quick basics

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- Apply the **CIA concept** to all **information**:
  - Emails
  - Banking
  - Health
  - Photos / Videos / Docs
  - Private conversations

- And to **all the gates to access** (attack surface):
  - Webs
  - Mobile apps
  - Desktops
  - Networks

Quick basics: The (ideal) theory

- **Programmers:** Secure coding.
- **Systems:** Design secure infrastructures and configurations.
- **Providers:** Both.
- **Users:** Avoid deceitful content.

Quick basics: The reality

- **Programmers:** ~~Secure coding~~. Quick fixes to ensure the deadline:
  - It works, right? Leave it like that, we will improve it later (kek)
- **Systems:** ~~Design secure infrastructures and configurations~~. No design stage, firemen all around:
  - 90% CPU usage. Auto-scale kubernetes. Latency is high, refactoring is needed (never ending technical debt)
- **Providers:** ~~Both~~. Same problems, but now on millions of products:
  - Is your product secure?
  - × Yes !!! (Does not know what product does).

Quick basics: The reality

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- **Users:** ~~Avoid deceitful content.~~ Prompting creds on worst phishing websites:
  - *I saw Pablo Motos' new crypto strategy on Facebook and logged in with Gmail* (he is on the police station, -300€ on his account).

Quick basics: How to fix it

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Programmers

Systems

Providers

Users

SDLC

Cybersec

Awareness

S-SDLC

Quick basics: Cybersec Industry

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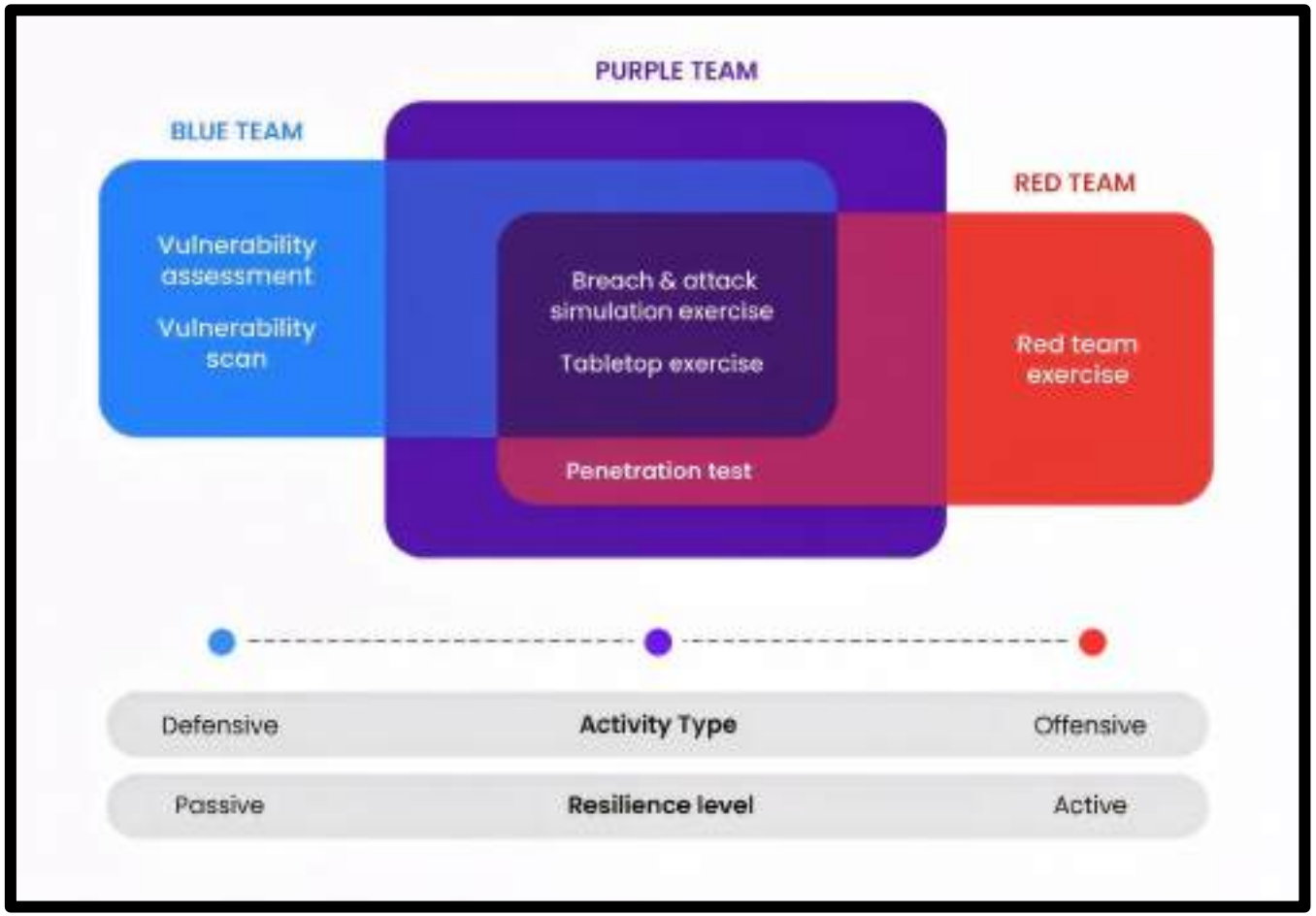

Pentesting: Goals, stages and kinds

Pentesting: WWW (What, when, why)

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What? An asset that the company wants to verify:

- A new development
- A new feature
- A new device
- A new deployment / server
- A new network config
- Any of the above but old or never tested before (yikes)
- Any of above from a provider

Pentesting: WWW (What, **when**, why)

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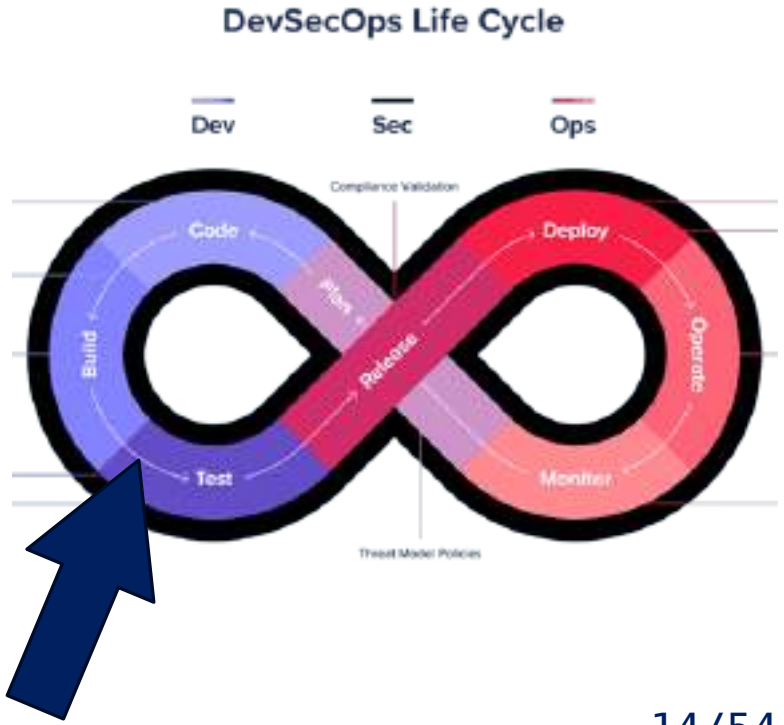
When? The timing to perform a pentest (from ideal to usual):

- On final QA stage (1 month before go-live date)
- Last development stages, logic is final (along with QA tests)
- Go-live is tomorrow (f**k we forgot the pentest)(asap plz)
- We got breached!!! (lesson learnt)
- Product is live.
- When policy states it (PCI, ISO27001, etc…)



Pentesting: WWW (What, when, why)

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Why?

- Because **we care about our users and their data** (do they?)
- Because policy says so (first bullet is not required)
- Because we need support data for stakeholders/investments
- Because we don’t trust our provider
- Because we got breached (need to fix things and build up reputation)

Pentesting: Goals

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To find vulnerabilities in the asset/s for the client to fix them. In summary, to improve the product/environment. Period.

Easy, right?

Pentesting: Stages

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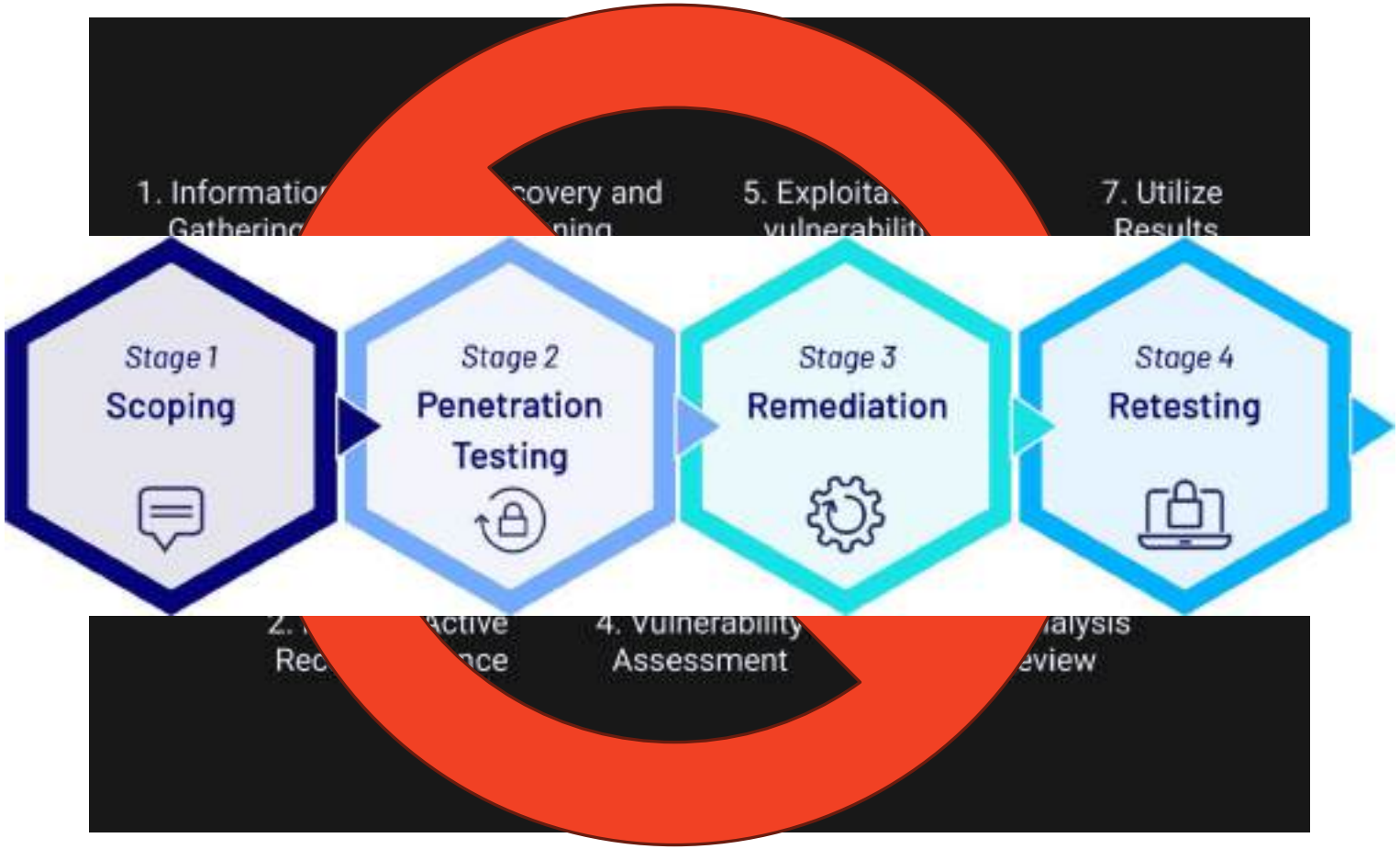

Pentesting: Kinds

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External Penetration Test

- Web, Web3, APIs
- Mobile (Android, iOS)
- Infrastructure, Networks
- IoT, Radio
- WiFi
- Binaries, Desktop Apps
- …

Internal Penetration Test

- Cloud: AWS, Azure, GCP
- Infra, Networks (Cloud/Prem)
- Offices
- Printers, OT
- …

Pentesting: Kinds

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External Penetration Test

Final attack surface is exposed to the internet or via whitelist

Internal Penetration Test

Attack surface is within DMZ or the internal company network

Pentesting: The reality

Pentesting: The Real Stages

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Kickoff

Setup

Pentest

Remediation

Retest

Pentesting: The Real Stages

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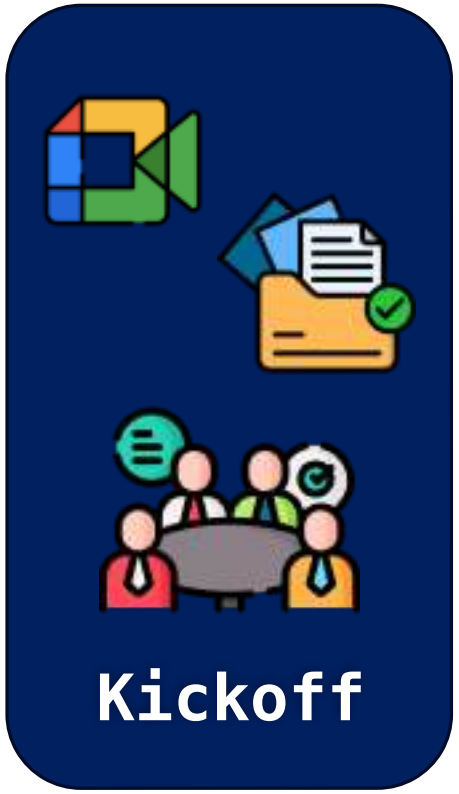

- Meet the scope, stablish ***RED LINES***
- Get to know the asset (show the app functionality…)
- Ask as much information as possible (depends):
  - Technologies, environment, roles, dependencies, arch…
- Ask for documentation (Swaggers, BOMs, Diagrams…)
- Establish an execution timeline (hard)
- “We don’t need a pentest”, “We do pentest every year”…

Pentesting: The Real Stages

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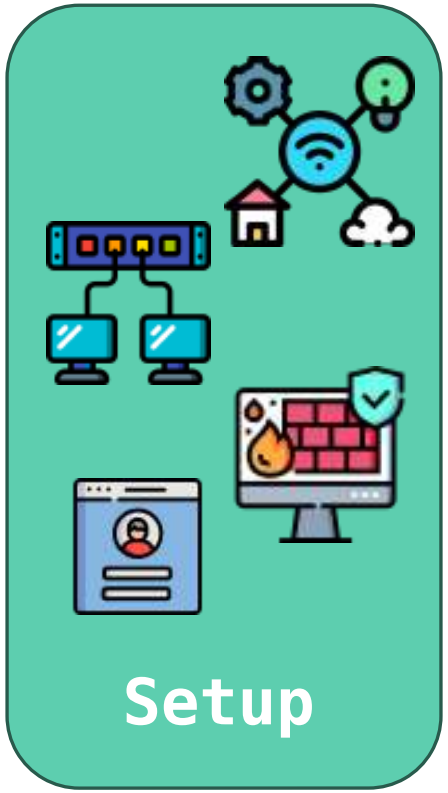

- All the requirements must be clear:
  - The scope: Domains, endpoints, IPs, devices, etc…
  - The users required
  - The timeframe
  - The IPs for the whitelist / VPN to access
- Test the access to the assets and the users.
- Technical proposal?
- Get into the context beforehand.
- Issues: Back and forth. People not answering, client doesn’t understand its own infra, vibecoders, freelancers…

Pentesting: The Real Stages

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Pentest

- Reconnaissance (attack surface).
- Implement the methodology: OWASP, MASTG, OSSTMM, NIST…
- Discover **as much vulns as possible**,
- Exploit the vulns, get in the dirt.
- Get all the evidences!!
- Report
- Issues: Unstable infra, half-implemented functionality…

Pentesting: The Real Stages

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Remediation

- The company received the report and responsibilities are set.
- Sometimes, explanation meet is required.
- Policies establish time to fix vulns, ex. Critical – 2 weeks.
- Also problems: This is not a vuln, it’s a feature. Furious providers, back and forth. Not fixing the vulns (they appear the next year)…

Pentesting: The Real Stages

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Retest

- Comeback over the pentest findings. Dig a bit deeper
- Revaluate the vulns (why?)
- Generate a new report with retest notes
- More problems: Devs tells to manager its fixed (its not), retest after 1+ years, not fixing vulns…

Kind of pentests (techs)

What do we pentest?

Basically, any asset. What I have done:

- Web: webs from the 2000s up to web3.
- Mobile apps: both from Android and iOS, from basic to banking apps.
- Android TPVs (Cards) and phone apps within.
- Hardware: Surveillance cameras, tills, light bulbs, display systems, laptops…
- IoT / Radio / WiFi: The above + LoRa/Zigbee sensors and gateways. WiFi nets.
- Offices: All kind of scrap, Hosts, VoIPs, printers, NAS, CCTVs, Keyboards.
- AI: Prompt injections, video summarizations
- AWS and cloud… I skip : K8s, Network policies, Firewall rules…

What do we pentest?

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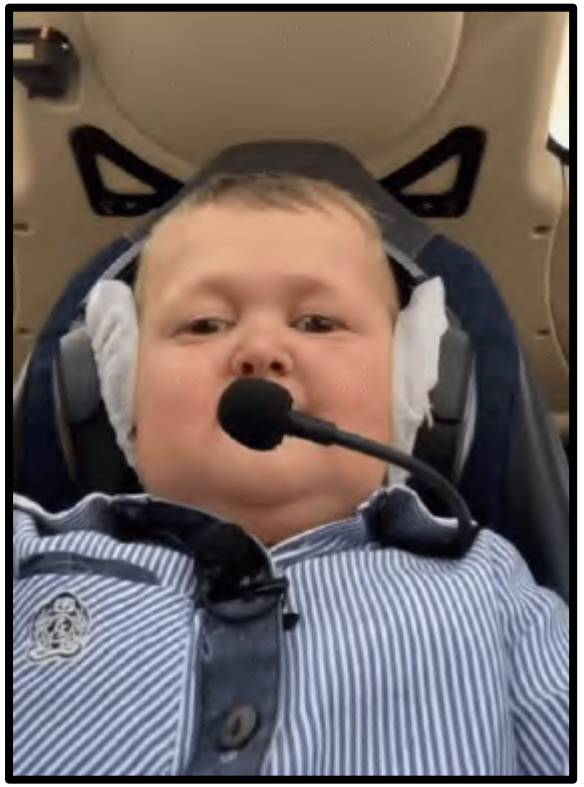
Too much theory, so me something technical please!!!

Web/API Pentest

Shopping list at the kickoff:

- Target URLs (host IP for further checks?)
- Users (as much roles as possible)
- Documentation (APIs)
- Whitelisted at WAF (why?)

Now we are ready!!!



Web/API Pentest

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Information Gathering

- Manually explore the site
- Spider/crawl for missed or hidden content
- Check for files that expose content, such as robots.txt, sitemap.xml, .DS_Store
- Check the caches of major search engines for publicly accessible sites
- Check for differences in content based on User Agent (eg, Mobile sites, access as a Search engine Crawler)
- Perform Web Application Fingerprinting
- Identify technologies used
- Identify user roles
- Identify application entry points
- Identify client-side code
- Identify multiple versions/channels (e.g. web, mobile web, mobile app, web services)
- Identify co-hosted and related applications
- Identify all hostnames and ports
- Identify third-party hosted content

Configuration Management

- Check for commonly used application and administrative URLs
- Check for old, backup and unreferenced files
- Check HTTP methods supported and Cross Site Tracing (XST)
- Test file extensions handling
- Test for security HTTP headers (e.g. CSP, X-Frame-Options, HSTS)
- Test for policies (e.g. Flash, Silverlight, robots)
- Test for non-production data in live environment, and vice-versa
- Check for sensitive data in client-side code (e.g. API keys, credentials)

Secure Transmission

- Check SSL Version, Algorithms, Key length
- Check for Digital Certificate Validity (Duration, Signature and CN)
- Check credentials only delivered over HTTPS
- Check that the login form is delivered over HTTPS
- Check session tokens only delivered over HTTPS
- Check if HTTP Strict Transport Security (HSTS) in use

Authentication

- Test for user enumeration
- Test for authentication bypass
- Test for bruteforce protection
- Test password quality rules
- Test remember me functionality
- Test for autocomplete on password forms/input
- Test password reset and/or recovery
- Test password change process
- Test CAPTCHA
- Test multi factor authentication
- Test for logout functionality presence
- Test for cache management on HTTP (eg Pragma, Expires, Max-age)
- Test for default logins
- Test for user-accessible authentication history
- Test for out-of channel notification of account lockouts and successful password changes
- Test for consistent authentication across applications with shared authentication schema / SSO

Session Management

- Establish how session management is handled in the application (eg, tokens in cookies, token in URL)
- Check session tokens for cookie flags (httpOnly and secure)
- Check session cookie scope (path and domain)
- Check session cookie duration (expires and max-age)
- Check session termination after a maximum lifetime
- Check session termination after relative timeout
- Check session termination after logout
- Test to see if users can have multiple simultaneous sessions
- Test session cookies for randomness
- Confirm that new session tokens are issued on login, role change and logout
- Test for consistent session management across applications with shared session management
- Test for session puzzling
- Test for CSRF and clickjacking

Authorization

- Test for path traversal
- Test for bypassing authorization schema
- Test for vertical Access control problems (a.k.a. Privilege Escalation)
- Test for horizontal Access control problems (between two users at the same privilege level)
- Test for missing authorization

Data Validation

- Test for Reflected Cross Site Scripting
- Test for Stored Cross Site Scripting
- Test for DOM based Cross Site Scripting
- Test for Cross Site Flashing
- Test for HTML Injection
- Test for SQL Injection
- Test for SOQL Injection
- Test for LDAP Injection
- Test for ORM Injection
- Test for XML Injection
- Test for XXE Injection
- Test for SSI Injection
- Test for XPath Injection
- Test for XQuery Injection
- Test for IMAP/SMTP Injection
- Test for Code Injection
- Test for Expression Language Injection
- Test for Command Injection
- Test for Overflow (Stack, Heap and Integer)
- Test for Format String
- Test for incubated vulnerabilities
- Test for HTTP Splitting/Smuggling
- Test for HTTP Verb Tampering
- Test for Open Redirection
- Test for Local File Inclusion
- Test for Remote File Inclusion
- Compare client-side and server-side validation rules
- Test for NoSQL injection
- Test for HTTP parameter pollution
- Test for auto-binding
- Test for Mass Assignment
- Test for NULL/Invalid Session Cookie

Denial of Service

- Test for anti-automation
- Test for account lockout
- Test for HTTP protocol DoS
- Test for SQL wildcard DoS

Business Logic

- Test for feature misuse
- Test for lack of non-repudiation
- Test for trust relationships
- Test for integrity of data
- Test segregation of duties

Cryptography

- Check if data which should be encrypted is not
- Check for wrong algorithms usage depending on context
- Check for weak algorithms usage
- Check for proper use of salting
- Check for randomness functions

Risky Functionality - File Uploads

- Test that acceptable file types are whitelisted
- Test that file size limits, upload frequency and total file counts are defined and are enforced
- Test that file contents match the defined file type
- Test that all file uploads have Anti-Virus scanning in-place.
- Test that unsafe filenames are sanitised
- Test that uploaded files are not directly accessible within the web root
- Test that uploaded files are not served on the same hostname/port
- Test that files and other media are integrated with the authentication and authorisation schemas

Risky Functionality - Card Payment

- Test for known vulnerabilities and configuration issues on Web Server and Web Application
- Test for default or guessable password
- Test for non-production data in live environment, and vice-versa
- Test for Injection vulnerabilities
- Test for Buffer Overflows
- Test for Insecure Cryptographic Storage
- Test for Insufficient Transport Layer Protection
- Test for Improper Error Handling
- Test for all vulnerabilities with a CVSS v2 score > 4.0
- Test for Authentication and Authorization issues
- Test for CSRF

HTML 5

- Test Web Messaging
- Test for Web Storage SQL injection
- Check CORS implementation
- Check Offline Web Application

Web/API Pentest

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- Information Gathering
- Configuration Management
- Data Validation
- Authentication
- Authorization
- Secure Transmission
- Session Management
- Denial of Service (?)
- Business Logic
- Cryptography
- Risky Functionality - File Uploads, Cards

Web/API Pentest

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Wild things:

- GraphQL introspection > Unauth crypto transfers > 2M$
- Comment in JS > Secret URL > File naming convention > 10k DNIs
- Document metadata > Vuln PDF lib > RCE > 500k Invoices
- CompanyNameAdmin:CompanyNameWinter2020! > Full Dashboard Access > SSTI on Invoice Engine > LFI > 3k DNIs
- Vacation approval tool > Ofuscated actions with Ids > Reverse > Broken Access Control > Unlimited vacacions

Mobile Pentest

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Mobile Pentest

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Mobile Pentest

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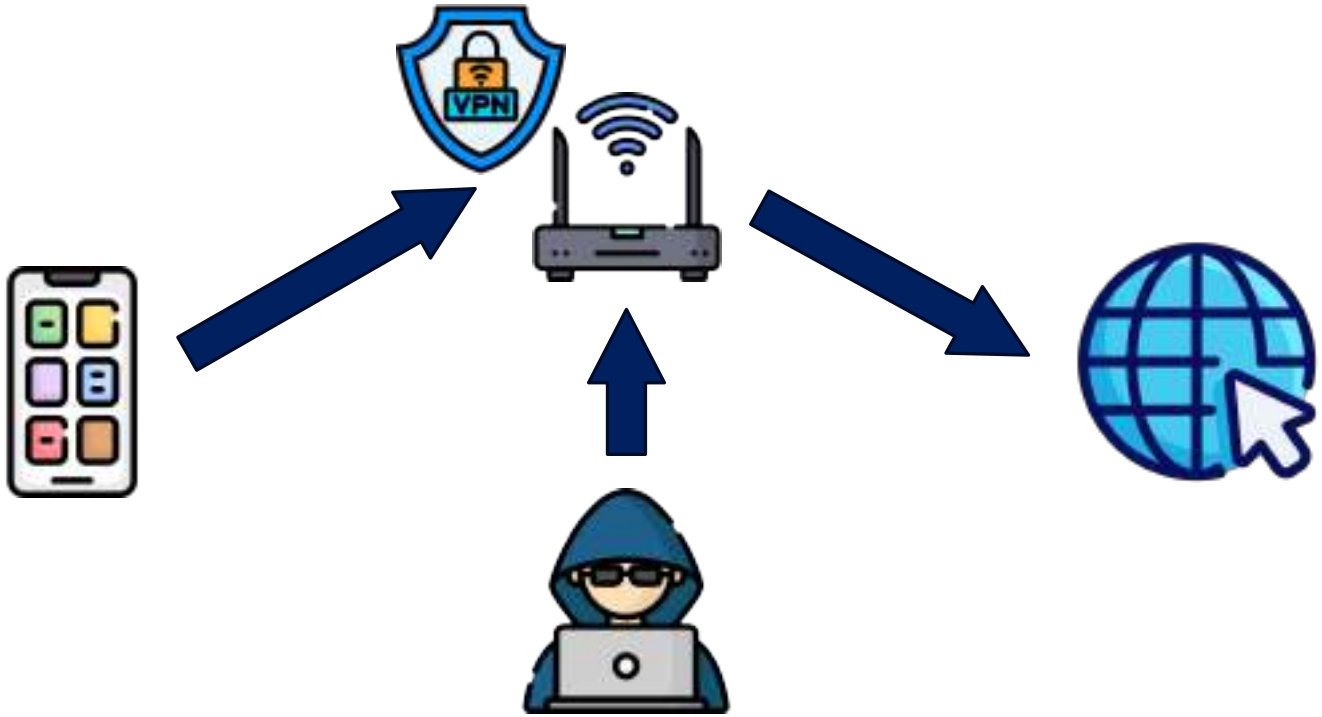
Mobile Setup



Jailbroken / Rooted Device

Lab setup:

- Physical device (?)
- Magisk
- LSPosed
- File Monitoring
- Drozer
- tcpdump

BurpSuite

Mobile Pentest

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Basically API + New attack surface at the phone:

- IPCs (Inter-Process Communication)
- mydeust0app://thisisaninput
- Peripherals
- How data is stored
- Client-side functionality
- App resilience (environment, network…)
- Android != iOS

Mobile Pentest

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OWASP MAS Testing Profiles:

- MAS-L1 - Essential Security: Low risk data, baseline
  - The device is not rooted/jailbroken
  - Not viewed as an adversary. Other apps are adversary.
- MAS-L2 - Advanced Security: High risk data
  - The device is rooted/jailbroken
  - Not viewed as an adversary. Other apps are adversary.
- MAS-R - Resilient Security: Safeguard their own assets and logic
  - The device is rooted/jailbroken
  - Viewed as an adversary. Other apps are adversary.

Mobile Pentest

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Wild things:

- Client-side logic > SMTP
- Card data into system logs
- Custom authorization > Reverse > Broken Access Control > Bypass email confirmation > Digital Key
- Export confidential data > Just print

Other Pentest

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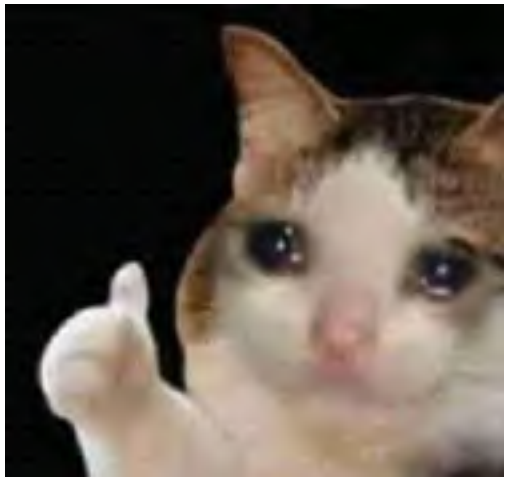
Other wild things:

- From provider VPN > Access internal network > Discover Conference gear > Default creds > CEO / StakeHolder meeting
- Hard OSINT over company > S3 Disclosure > Google Chat Screenshots > Unknown domain name > companyname:12345678 FTP with sensitive data



Red Team and Pentest: Close yet so far.

Red Team & Pentest

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- **Penetration test:**
  - Limited assets (web, app, host…)
  - Short time (1-4 weeks)
  - No social engineering
  - No physical intrusion
  - Collaboration with DevSecOps (client)
- **Red Team:**
  - Any asset within the company
  - Long time (6-12 months)
  - Social engineering
  - Physical intrusion allowed (?)
  - No collaboration, only White Team communication

Radio / HW Gear

Miscellaneous

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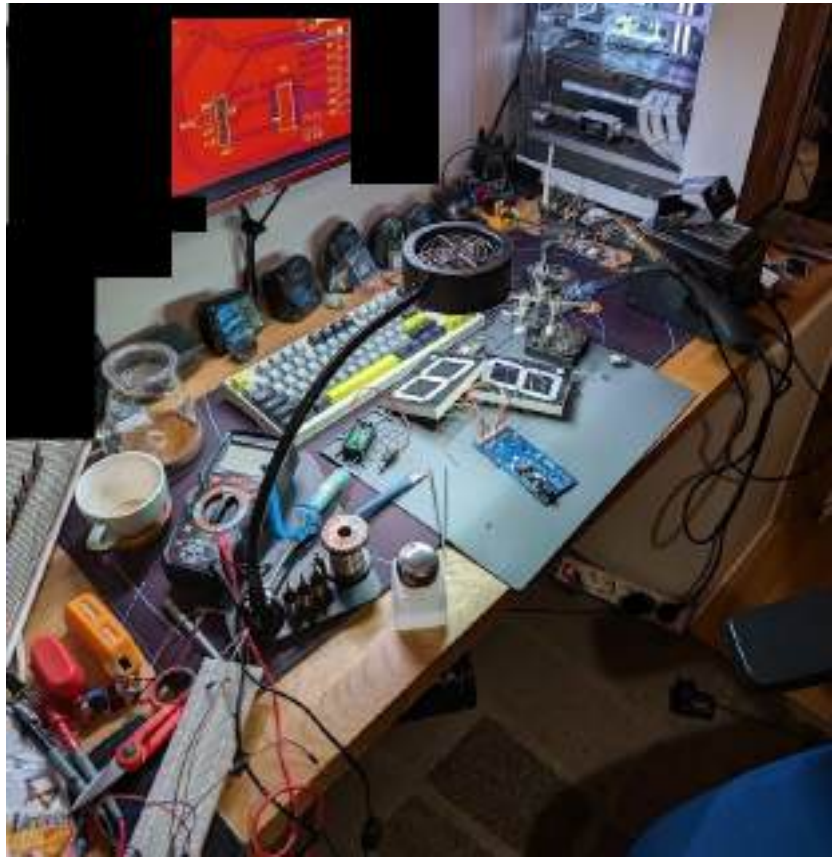
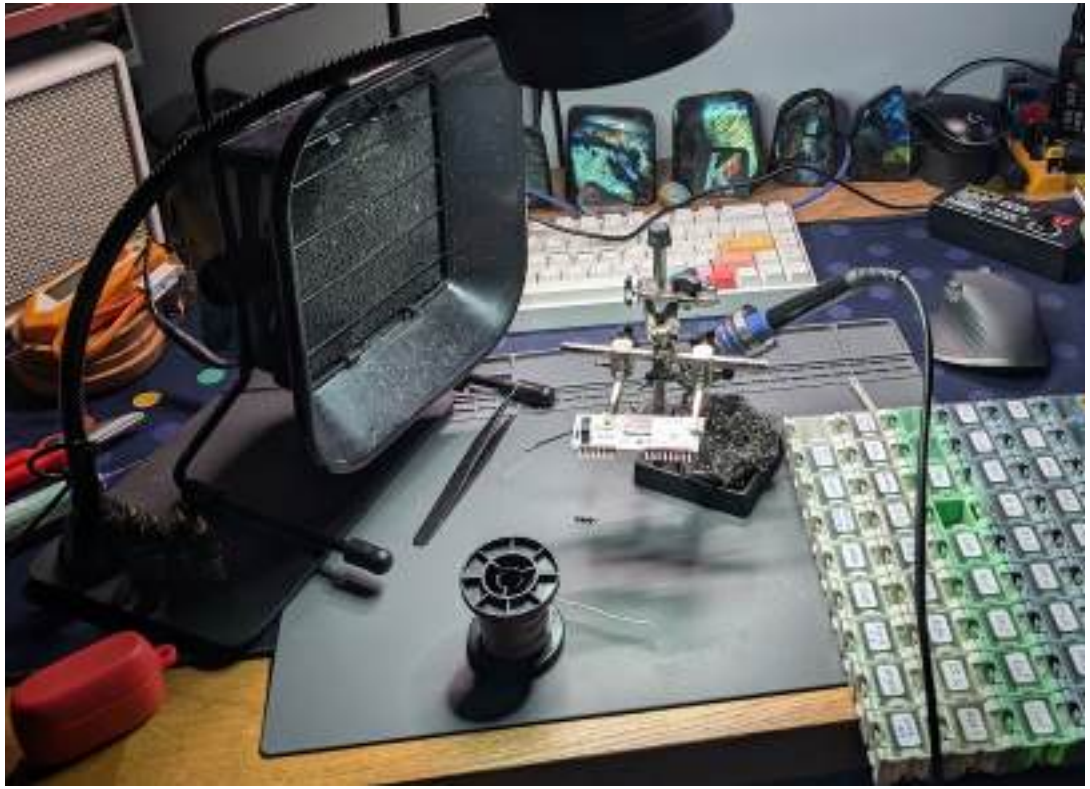
YouTube

Miscellaneous





Miscellaneous

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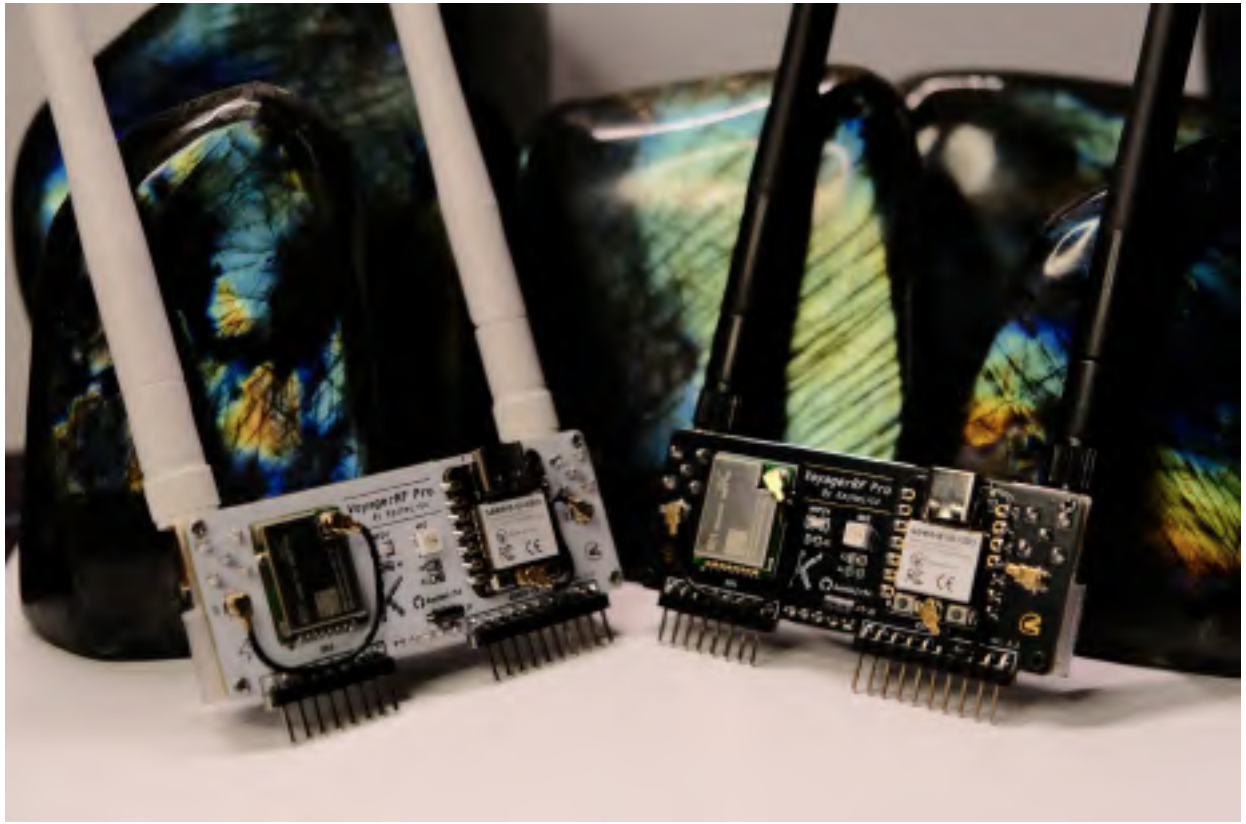

Thanks for your attention!

Thanks to 0xd3c0d3

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