TWOEFAY

Multifactor Authentication System

THE AEROSPACE CORPORATION

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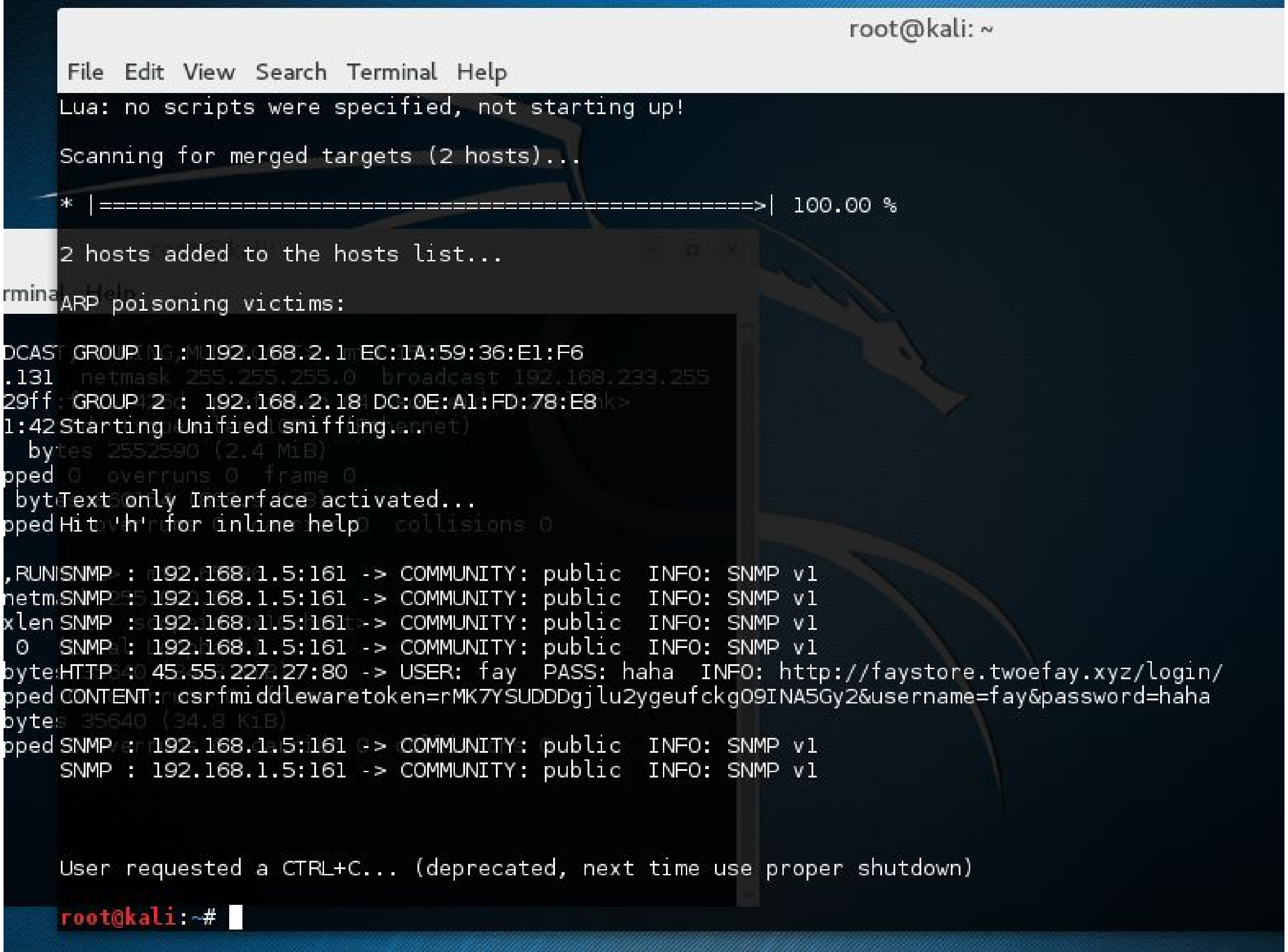
Intro & Problem Statement

- Current log-in systems: 1-factor authentication (password)
- Easy to get hacked
- Adding additional factors raises security
- Problem Statement: Create a multi-factor authentication system that easily integrates into existing website log-in systems

Motivation

- Easier to use --> More likely to use
- Simplifies and greatly improves website security
- Integrate Twoefay into log-in system
- Install app on iPhone
- 3-factor: password, phone, fingerprint

DEMO



```
Lua: no scripts were specified, not starting up!

Scanning for merged targets (2 hosts)...

* |==================================================>| 100.00 %

2 hosts added to the hosts list...

ARP poisoning victims:

 GROUP 1 : 192.168.2.1 EC:1A:59:36:E1:F6

 GROUP 2 : 192.168.2.18 DC:0E:A1:FD:78:E8
Starting Unified sniffing...


Text only Interface activated...
Hit 'h' for inline help

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HTTP : 45.55.227.27:80 -> USER: fay  PASS: haha  INFO: http://faystore.twoefay.xyz/login/
CONTENT: csrfmiddlewaretoken=rMK7YSUDDDgjlu2ygeufckgO9INA5Gy2&username=fay&password=haha

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User requested a CTRL+C... (deprecated, next time use proper shutdown)

root@kali:~# 
```

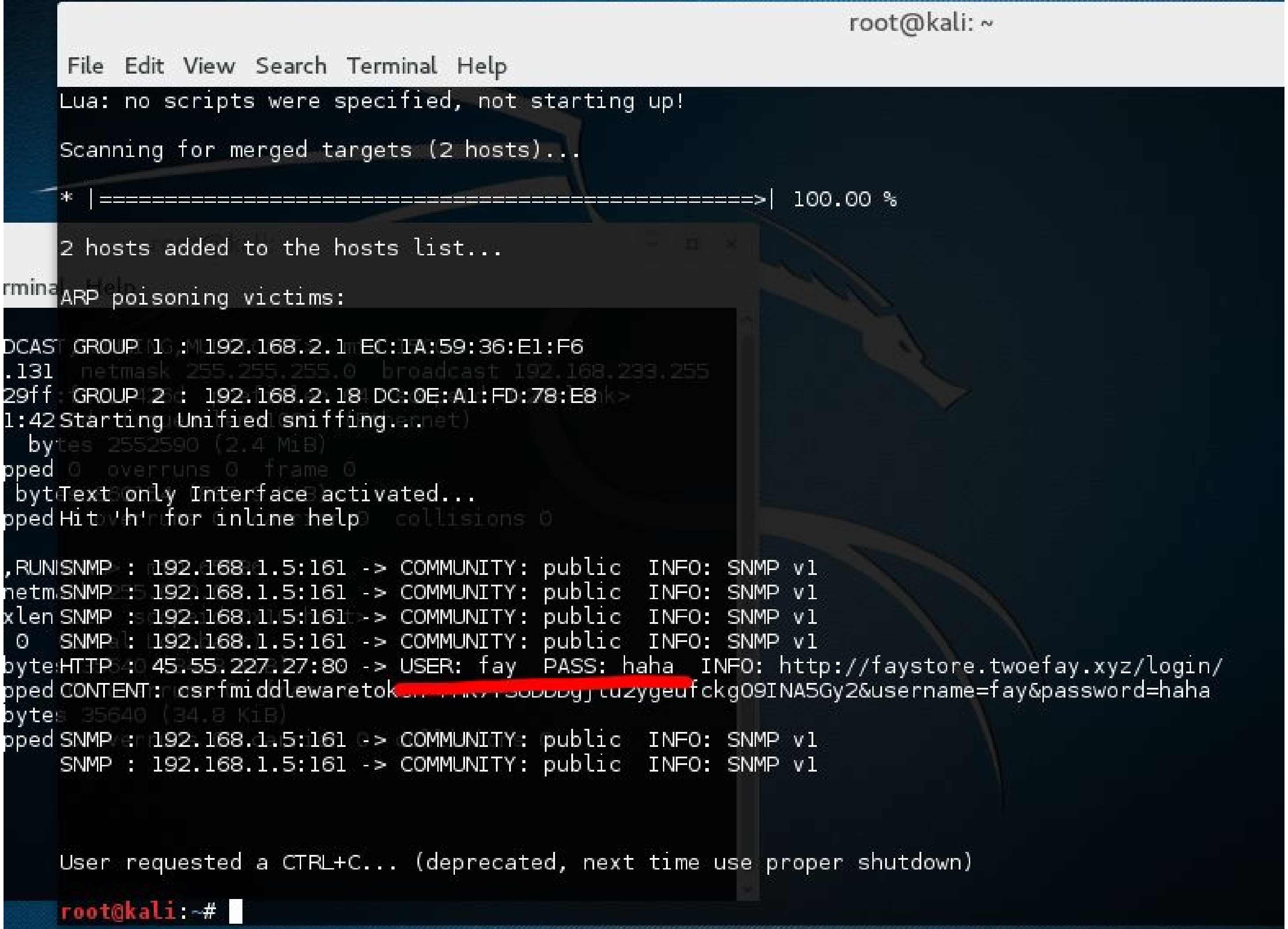

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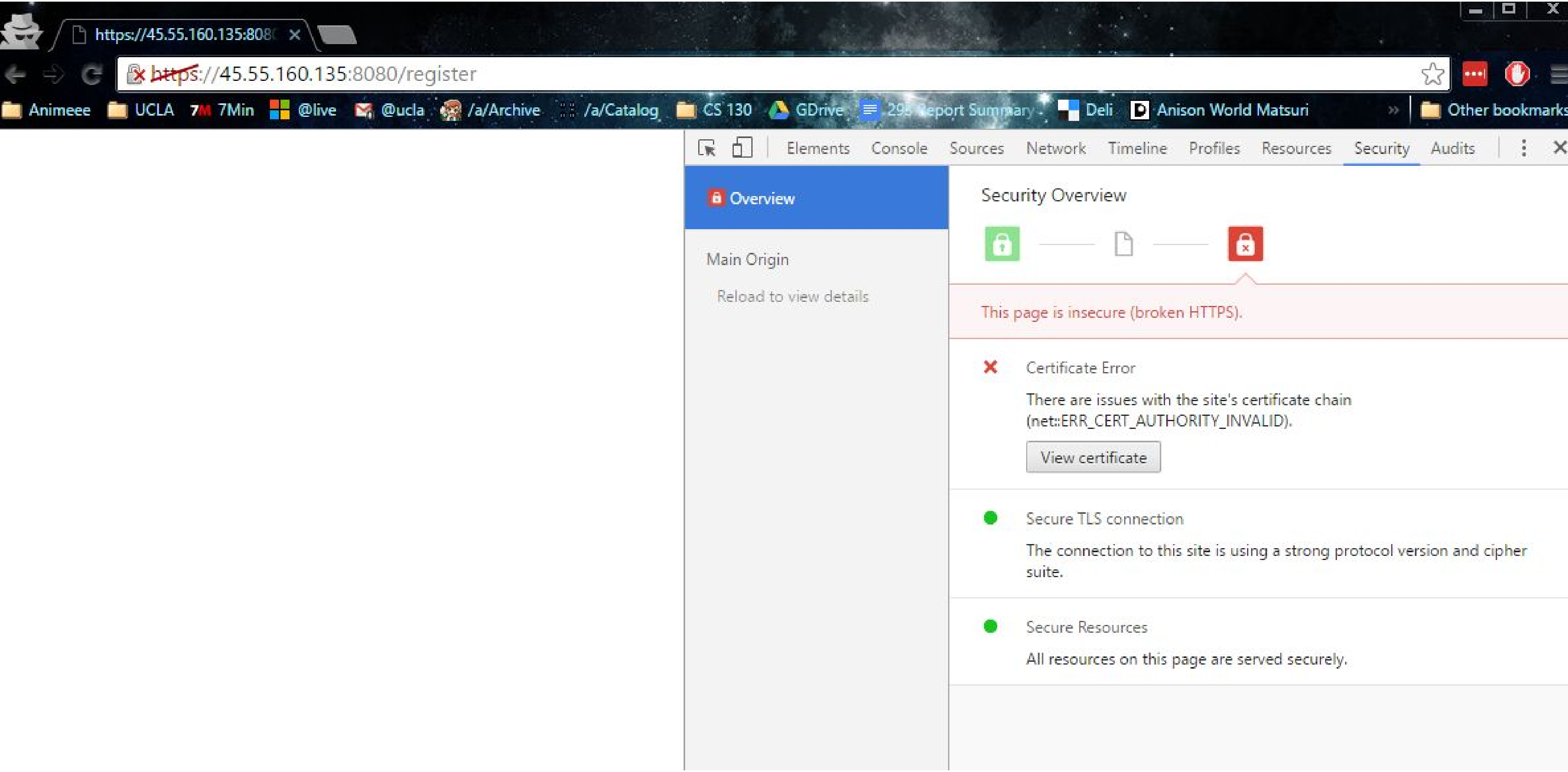
Infrastructure

- Digital Ocean (3 droplets)
- twoefay.xyz
- systemd daemons
- Let’s Encrypt!



Security Overview

This page is insecure (broken HTTPS).

✗ Certificate Error

There are issues with the site's certificate chain (net::ERR_CERT_AUTHORITY_INVALID).

● Secure TLS connection

The connection to this site is using a strong protocol version and cipher suite.

● Secure Resources

All resources on this page are served securely.

Client Website

- **Purpose:** Demo
- **Tech:** Python + Django web framework
- **Issues:**
    - Client website existing user authentication library inflexibility
    - Lack of async requests

Twoefay Server

- **Purpose**: Main mediator
- **Tech**: Python + Hyper, Twisted framework
- **Issues**:
  - HTTP/2.0 (required for APN communication)
  - Certificate verification woes

APN Communication

- **Purpose**: Apple push notifications
- **Tech**: Python + Flask framework
- **Issues**:
    - Apple certificates and provisioning profiles
    - Integrating with nghttp2

iOS Client

- **Purpose:**
    - Register with Client website
    - Receive Push Notifications
    - Send Authentication/Denial Message to Python ServerRealm (History)
- **Libraries:**
    - Alamofire (HTTP Requests)
    - SwiftyJSON (APN Parsing)
    - Realm (History)

For the Future...

- Limitations:
    - iOS client only - Android / Windows for the future
    - Client-specific app - app should be able to integrate with 1+ log-in sites
    - Set up additional endpoint for back-up email option
- Protocol fall-back to HTTP/1.1
- Tighten security & improve performance / reliability

Known Vulnerabilities (1)

- Man in the Middle (MITM) Attacks
  - Attack: Captured username, password from using logging into Client
- Replay Attacks
  - Attack: Captured entire message, encrypted and all in transit
  - Countermeasure: Add nonce to encrypted message

Known Vulnerabilities (2)

- Attacker Steals id_token
  - Attack: Attacker can then register their phone and replace your phone, so push notifications get pushed to them instead
  - Countermeasure: Flag the account if the dev_token changes too often
- DDoS Attacks
  - Attack: Client websites will be unable to communicate with our Server, iOS App will be unable to receive push notifications
  - Countermeasure: Have extra servers

THANK YOU