Vulnerability Assessment
&
Penetration Testing

Report Title: VAPT Report on DVWA

Internship Batch: Future Interns

Report By: Anoopviswanathan

Table of Contents

Objective

Illustrate the successful setup on DVWA for Vulnerability Assessment and Penetration testing for demonstrate SQL injection, Cross-site scripting (xss) - Reflected,Command Injection, CSRFattacks and Brute Force attacks under “low” and “medium” security settings, along with PoC and remediation

Environment Setup

Platform: DVWA installed on Linux (Kali or equivalent)

Access URL: http://localhost/dvwa

Credentials: admin / password (default from setup exercise)

Initial Security Level: Set to Low via DVWA Security panel

Task Overview

According to Task 1:

- Log in to DVWA
- Switch DVWA security level between Low and Medium
- Explore Vulnerabilities
- Document of the findings

Methodology & Tools:

I Browser (Firefox)
I Burp Suite
I DVWA

Findings

Severity	Finding	Risk	CVSS v3 Score
Critical	SQL Injection in Login Form	Data breach	9.8
High	Insecure Direct Object References (IDOR)	Data exposure	8.7
High	Brute Force Attack	Password cracking	7.5
High	Cross-site request forgery (CSRF)	Social Engineering	7.5
High	Cross-site scripting (Xss reflected)	Impact on confidentiality	8.5

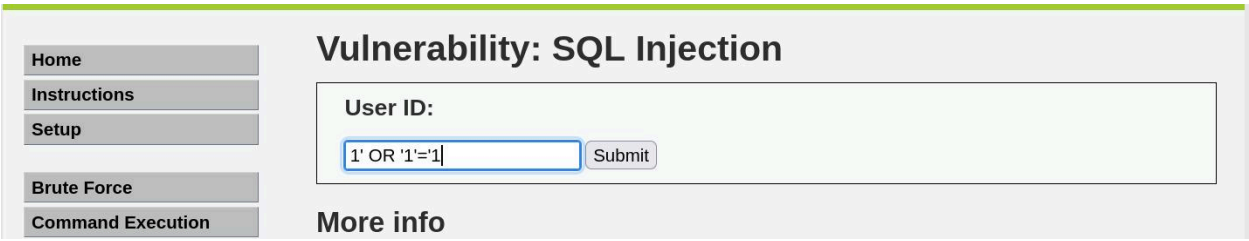
Evidence

1. SQL Injection in Login Form

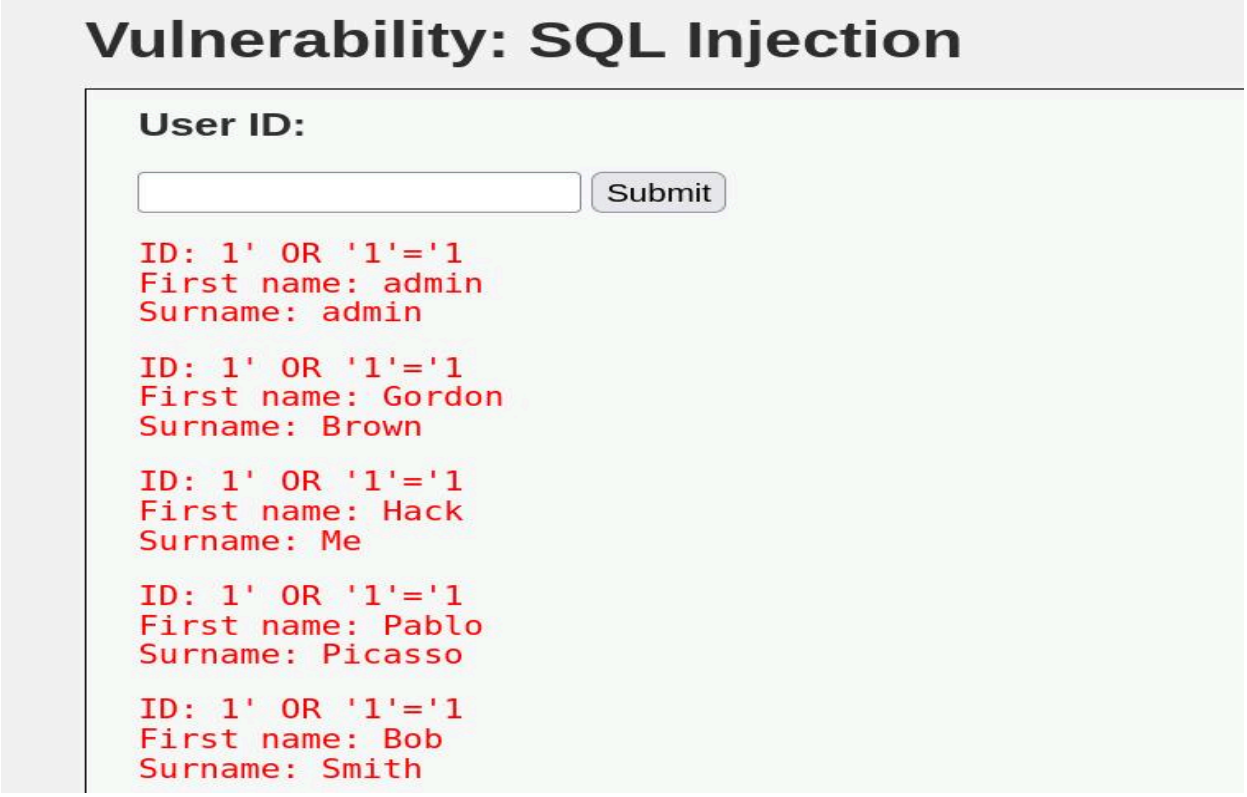
Location: http://localhost/dvwa/sqli

SQL Injection is a code injection technique that exploits improper input validation by inserting malicious SQL statements into an entry field, which are then executed by the backend database. This can lead to data leakage, authentication bypass, and in severe cases, full database compromise.

POC:



Injected the payload in the form field like **1’ OR ‘1’=’1** to check if the database have been triggered by this payload

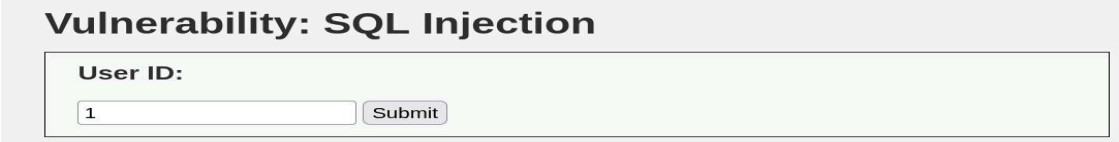


2. Insecure Direct Object Reference (IDOR)

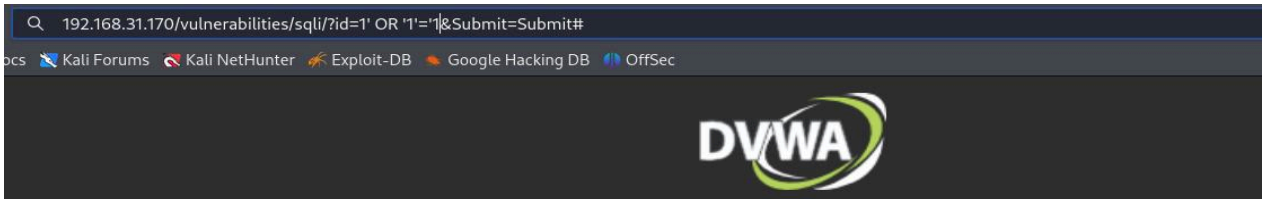
Location: http://localhost/dvwa/vulnerabilities/sqli/?id=1

IDOR occurs when an application exposes references to internal implementation objects such as files, database records, or keys, and these can be manipulated to access unauthorized data without proper authorization or access control.

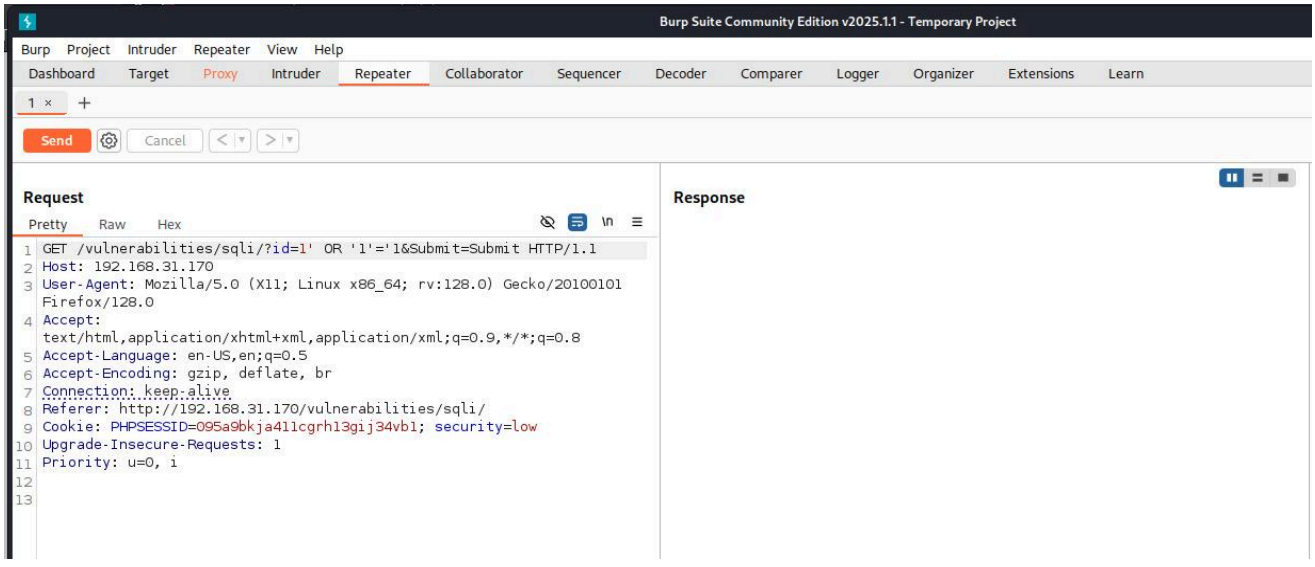
POC:



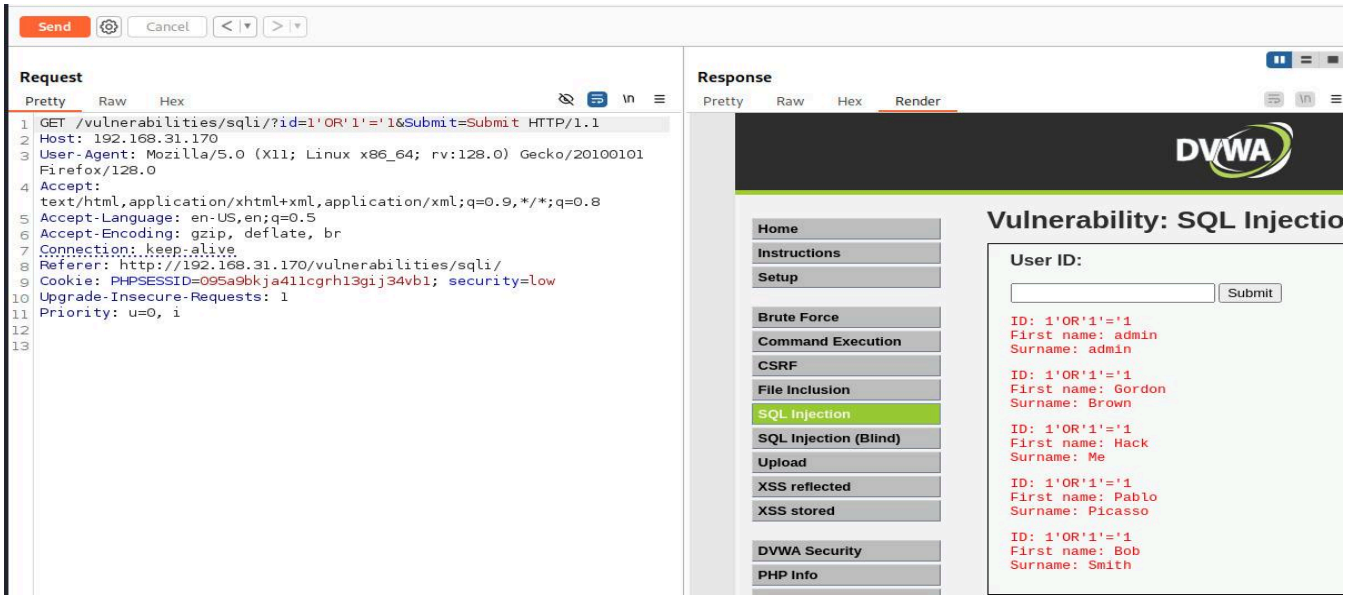
Entered the user Id in the form field to check the website url changes to test the IDOR vulnerability, throught injecting the payload command directly in the url creates a request in server



As we can see here the website's http request there is no https header so it is IDOR vulnerable



As we can see the request has been sent to the server and it renders the database of the user's first and sur name stored in the data base

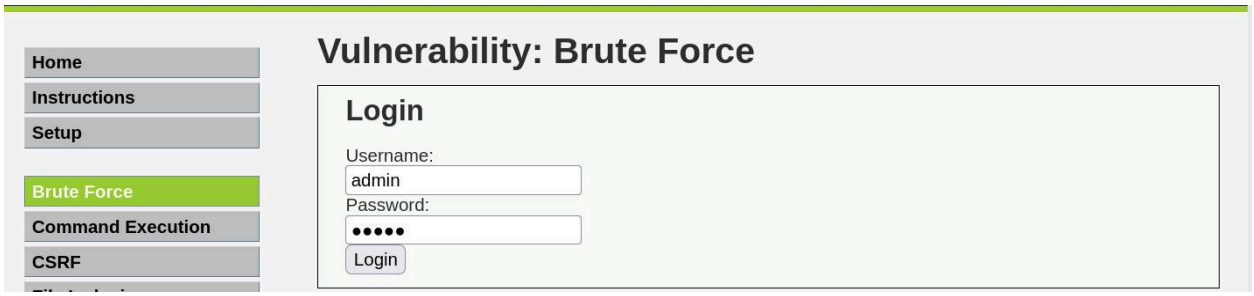


3.Brute Force Attack

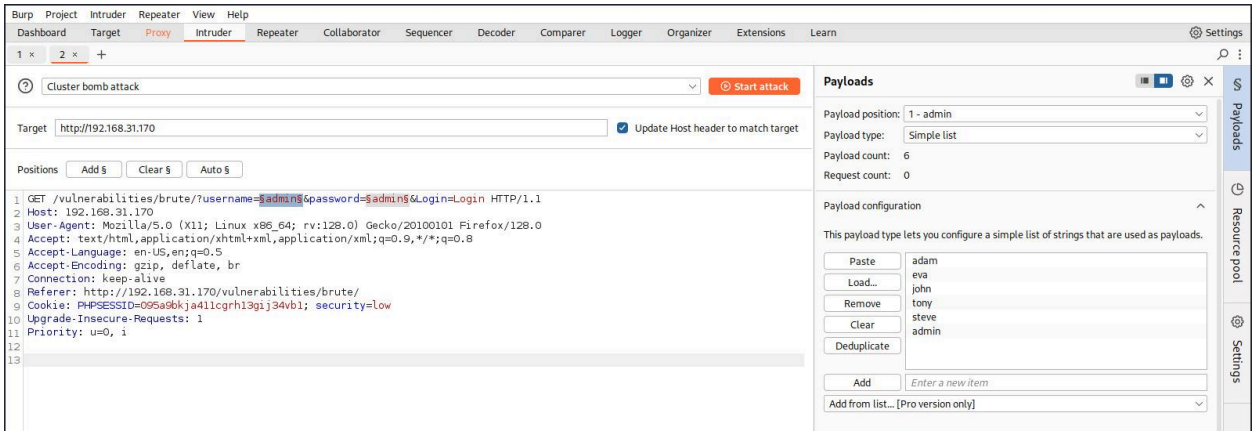
Location: http://localhost/dvwa/vulnerabilities/login.php

Brute Force attacks occur when an attacker attempts to gain unauthorized access by systematically guessing credentials (usernames/passwords) through repeated login attempts. Lack of rate limiting, CAPTCHA, or account lockout mechanisms enables this attack.

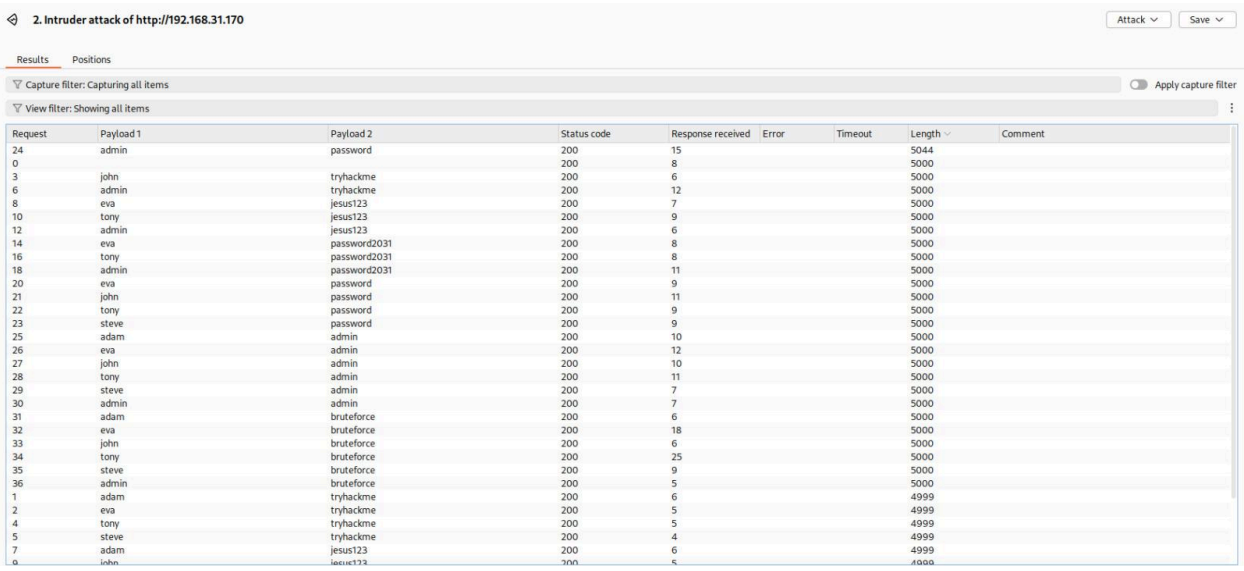
POC:



Intercepting the website request to view the structure of the website in the Burp Suite. After send the request to the intruder I have set the payloads for username and password with the technique of cluster bomb attack to brute force both simultaneously

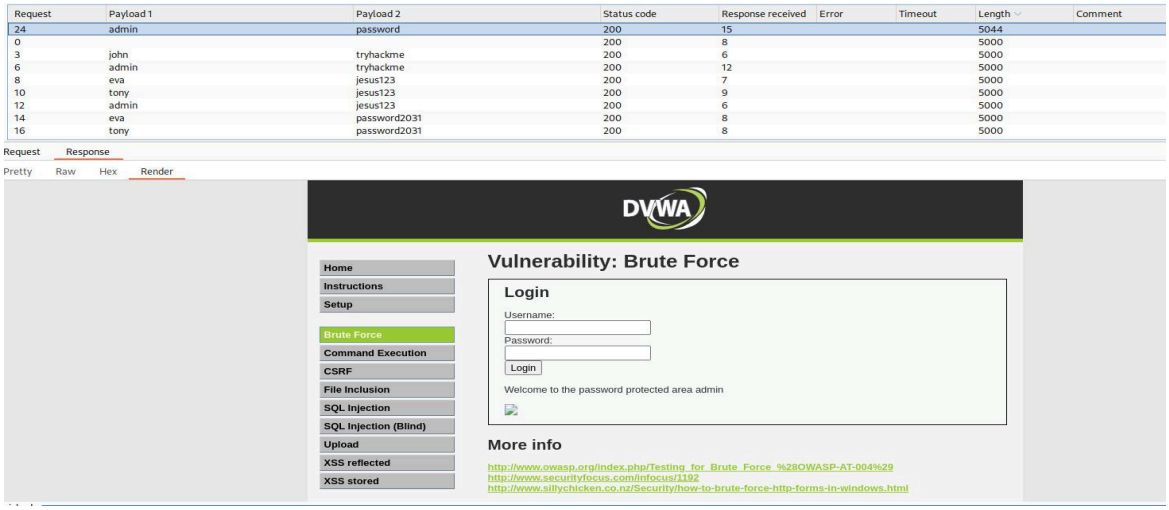


Trying all the combinations of username and password to identify the valid credentials of the admin via brute forcing as we can see by sorting the result bellow the length of one login is larger than any other login attempt



Request	Payload 1	Payload 2	Status code	Response received	Error	Timeout	Length	Comment
24	admin	password	200	15			5044	
0			200	8			5000	
3	john	tryhackme	200	6			5000	
6	admin	tryhackme	200	12			5000	
8	eva	jesus123	200	7			5000	
10	tony	jesus123	200	9			5000	
12	admin	jesus123	200	6			5000	
14	eva	password2031	200	8			5000	
16	tony	password2031	200	8			5000	
18	admin	password2031	200	11			5000	
20	eva	password	200	9			5000	
21	john	password	200	11			5000	
22	tony	password	200	9			5000	
23	steve	password	200	9			5000	
25	adam	admin	200	10			5000	
26	eva	admin	200	12			5000	
27	john	admin	200	10			5000	
28	tony	admin	200	11			5000	
29	steve	admin	200	7			5000	
30	admin	admin	200	7			5000	
31	adam	bruteforce	200	6			5000	
32	eva	bruteforce	200	18			5000	
33	john	bruteforce	200	6			5000	
34	tony	bruteforce	200	25			5000	
35	steve	bruteforce	200	9			5000	
36	admin	bruteforce	200	5			5000	
1	adam	tryhackme	200	6			4999	
2	eva	tryhackme	200	5			4999	
4	tony	tryhackme	200	5			4999	
5	steve	tryhackme	200	4			4999	
7	adam	jesus123	200	6			4999	

As we can render the result bellow shows that we have gained the admin privilege access control for that website

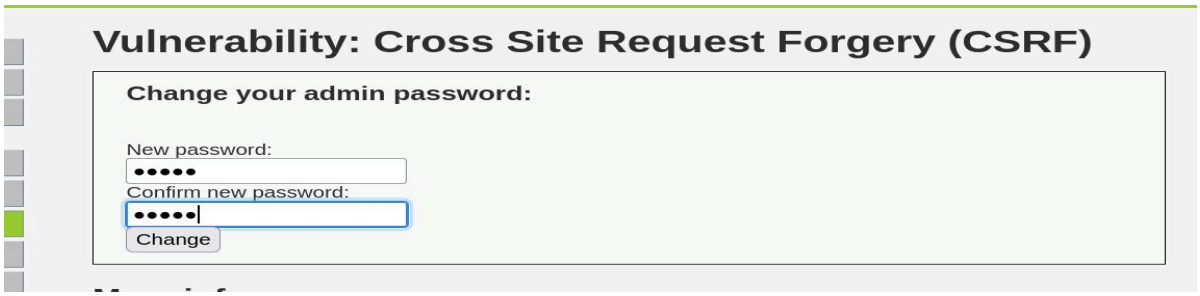


4. Cross-site Request Forgery

Location: Entire application

CSRF is an attack that forces a user to execute unwanted actions on a web application in which they are authenticated. By exploiting the trust a site has in the user's browser, attackers can perform state-changing actions (like changing passwords, updating profiles, or initiating financial transactions) without the user's consent.

POC:

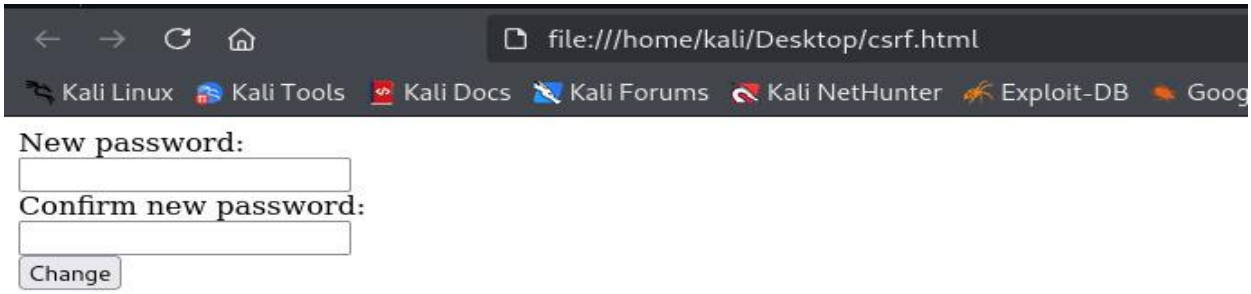


To change the password in any account without requesting to forget the password. View the website source page and look for the form contains the password changing features,There is a form field presented in the web site souce page that contains the option to change the new password

```
<div class="body_padded">
    <h1>Vulnerability: Cross Site Request Forgery (CSRF)</h1>

    <div class="vulnerable_code_area">

    <h3>Change your admin password:</h3>
    <br>
    <form action="#" method="GET">    New password:<br>
    <input type="password" AUTOCOMPLETE="off" name="password_new"><br>
    Confirm new password: <br>
    <input type="password" AUTOCOMPLETE="off" name="password_conf">
    <br>
    <input type="submit" value="Change" name="Change">
    </form>

    <pre> Password Changed </pre>

    </div>
```

copy the form field and create a separate file as csrf.html and paste the form in that file save and open as html file

As we can see below the html file shows a separate option for changing the password of the user website login



As we can see the result that without requesting the forget password option we can easily change the password of the user account

Analysis, Impact & Remidiation

1. SQLi Injection:

Analysis:

- **Expected Behavior:** The login form should validate credentials against the database and reject incorrect inputs

- **Observed Behavior:** The application accepted the input `1'OR '1'='1`, bypassed the password check, and logged the attacker in as the `admin` user.

Impact:

An attacker can bypass authentication, exfiltrate database contents, modify data, or potentially achieve Remote Code Execution (RCE) depending on the database and configuration.

Recommendation:

- Use **parameterized queries** or **prepared statements**.
- Employ **input validation** and **output encoding**.
- Implement a **Web Application Firewall (WAF)** to detect and block SQLi attempts.
- Conduct regular code reviews and security testing.

2. Insecure Direct Object Reference (IDOR):

Analysis:

- **Expected Behavior:** User A should not be able to access User B's profile.
- **Observed Behavior:** The server returned sensitive data for User B without validating ownership or access rights.

Impact:

- Unauthorized access to personal data of other users (PII exposure)
- Potential for account takeover or social engineeringViolation of data protection regulations (e.g., GDPR)

Recommendation:

- Enforce **object-level authorization** on all endpoints.
- Never trust client-side identifiers for access control decisions.
- Use **session-based ownership checks** on the server-side.
- Regularly test API endpoints for broken access control issues.

3. Brute Force Attack

Analysis:

Attempt	Payload	Status Code	Response size	Note
1	admin123	200	500	Invalid
2	password	302	512	Login

Impact:

- Unauthorized access to user/admin accounts.
- Potential full control over the application if privileged accounts are compromised.
- Risk of data theft, defacement, or further privilege escalation.

Recommendation:

- Implement **account lockout** after a defined number of failed attempts.
- Add **rate-limiting** and **CAPTCHA** on login endpoints.
- Use **multi-factor authentication (MFA)** for all users, especially admins.
- Monitor and alert on failed login attempts from a single IP.

4. Cross-Site Request Forgery (CSRF):

Analysis:

- No CSRF token was required.
- No re-authentication or origin header validation was enforced.
- The server processed the malicious request successfully and updated the user's email.

Impact:

- Unauthorized state changes performed without user interaction.
- Account takeover risks (e.g., email or password changes).
- Violation of user trust and potential legal/regulatory consequences (e.g., GDPR).

Recommendation:

- Implement **anti-CSRF tokens** (e.g., synchronizer tokens or double submit cookies).
- Validate **`Origin`** and **`Referer`** headers for state-changing requests.
- Use **SameSite cookies** set to `Strict` or `Lax`.
- Prompt re-authentication for sensitive actions (like email/password change).

Conclusion

The penetration test conducted on DVWA (Damn Vulnerable Web Application) successfully identified several critical and high-risk vulnerabilities that can be exploited by attackers to compromise the confidentiality, integrity, and availability of the application and its data. The following key vulnerabilities were discovered:

1. **SQL Injection (SQLi) –** Enabled unauthorized database access and authentication bypass through unsanitized input.

2. **Insecure Direct Object Reference (IDOR) –** Allowed unauthorized access to other users' sensitive data by manipulating object identifiers in the request.

3. **Brute Force Attack –** Revealed weak authentication controls due to the absence of rate-limiting, account lockouts, and CAPTCHA mechanisms.

4. **Cross-Site Request Forgery (CSRF) –** Permitted unauthorized state changes (e.g., email updates) via forged requests due to missing CSRF protection tokens.

These vulnerabilities highlight a lack of secure coding practices and insufficient implementation of access control and session management mechanisms.

While DVWA is intentionally vulnerable for educational purposes, this exercise emphasizes the importance of secure development practices, proper input validation, and comprehensive access control mechanisms in real-world applications.

🔐 Recommendations Summary

To mitigate the identified vulnerabilities, it is strongly recommended to:

- Sanitize and parameterize all user inputs.
- Implement access control checks at both the object and functional levels.
- Introduce account lockout and rate-limiting mechanisms.
- Use CSRF tokens and SameSite cookie attributes for all state-changing operations.

📌 Final Note

This penetration test was conducted in a controlled lab environment for learning and awareness purposes. In a production environment, such vulnerabilities can lead to serious breaches. Organizations are encouraged to follow secure coding standards, conduct regular security testing, and promote a strong security culture among development and operations teams.