7783 Information Security

Cloud Security Audit & Penetration Testing

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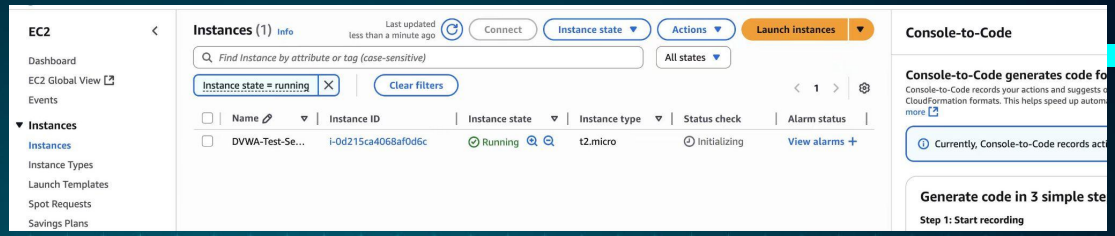
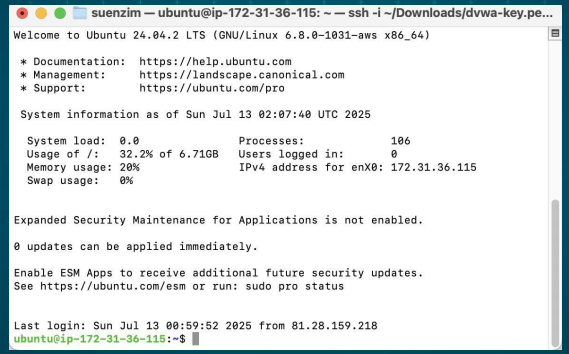
Agenda

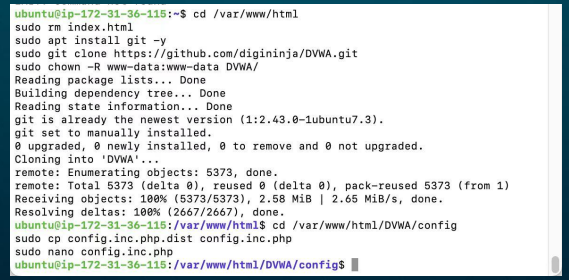
1. Web-hosted app set up on EC2
2. Security Review & Vulnerability Scan
3. Severity Analysis
4. Remediation Implementation
5. Summary

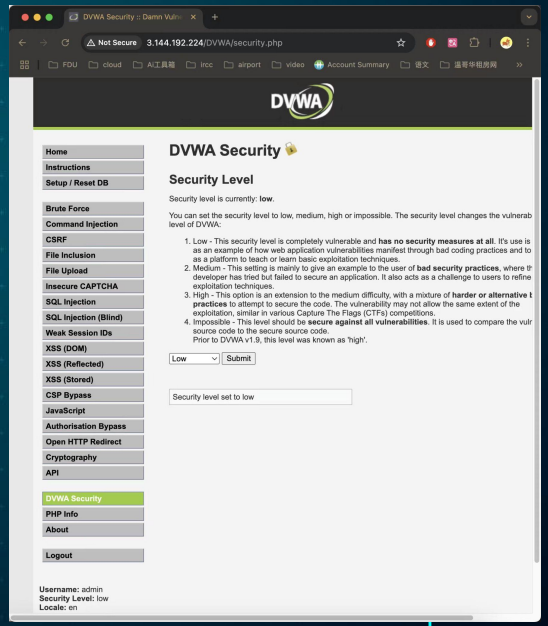
Web App Deployment on EC2

- A basic web application was deployed on an AWS EC2 instance running Ubuntu 20.04.
- Apache HTTP Server was installed to serve web content over port 80.
- SSH (port 22) was enabled for secure remote management.









EC2 Instance Configuration & Exposure

- EC2 instance ID: i-0d215ca4068af0d6c (Region: us-east-2)
- Ports 22 (SSH) and 80 (HTTP) were publicly accessible
- Confirmed by AWS Inspector with Medium and Low severity
- Configuration reviewed for exposure baseline
-

Scan Summary

- Tool Used: AWS Amazon Inspector
- Instance ID: i-0d215ca4068af0d6c
- Region: us-east-2
- Scan Time: 2025-07-12 20:30 (GMT-7)
- Scan Type: Network Reachability

Findings Overview

Severity	Title	Type	Status
Medium	Port 22 is reachable from an Internet Gateway – TCP	Network Reachability	Active
Low	Port 80 is reachable from an Internet Gateway – TCP	Network Reachability	Active

Detailed Analysis

1. **Port 22 (SSH) Open to Internet**
   - Severity: Medium
   - Description: SSH port is publicly accessible via TCP, which may allow brute-force login attempts if not properly secured.
   - Remediation:
     - Restrict SSH access to known IP addresses via AWS Security Groups.
     - Consider using a VPN or a bastion host for secure access.
     - Enforce key-based authentication and disable password login.
2. **Port 80 (HTTP) Open to Internet**

OWASP ZAP Scan

– **Directory Browsing**

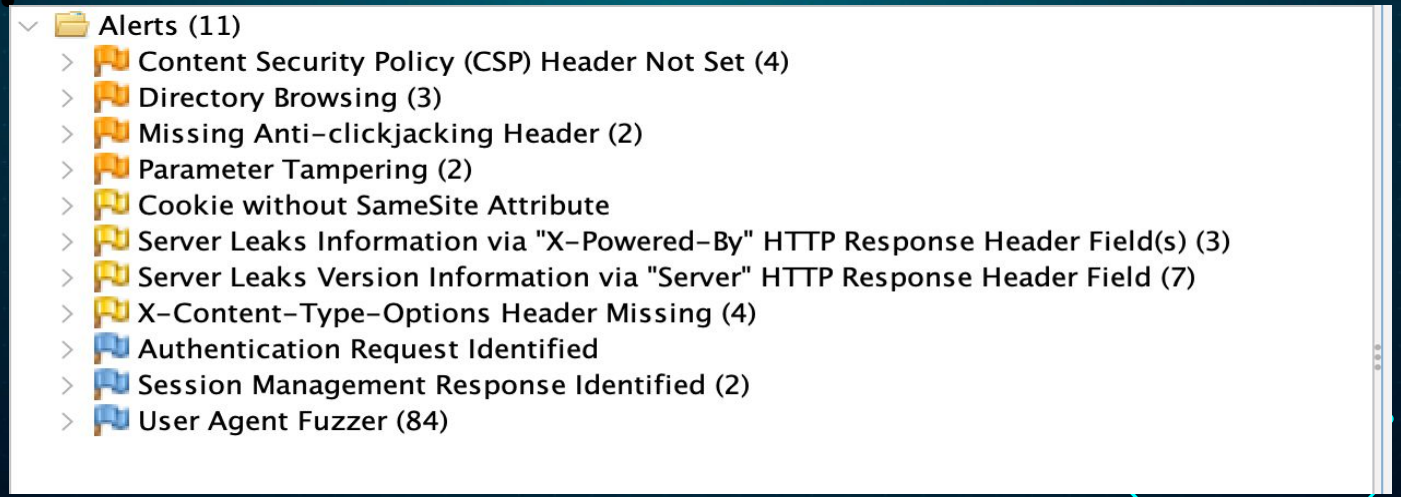
- **Issue**: The server allows directory listing, exposing contents of sensitive folders like `/images`, `/css`, etc.

– **Parameter Tampering**

- **Issue**: Application parameters (e.g., user ID, page ID) can be manipulated to access unauthorized data.

– **Clickjacking Vulnerability**

- **Issue**: Missing `X-Frame-Options` header allows framing by other websites, leading to clickjacking attacks.



Key Vulnerabilities – Medium Severity

Directory Browsing

URL: http://34.207.86.176/DVWA/dvwa/
Risk: Medium
Confidence: Medium
Parameter:
Attack: http://34.207.86.176/DVWA/dvwa/
Evidence: Parent Directory
CWE ID: 548
WASC ID: 48
Source: Active (0 – Directory Browsing)
Input Vector:

Description:

It is possible to view the directory listing. Directory listing may reveal hidden scripts, include files, backup source files, etc. which can be accessed to read sensitive information.

Other Info:

Solution:

Disable directory browsing. If this is required, make sure the listed files does not induce risks.

3. Missing Security Headers (MEDIUM)

X-Frame-Options Missing:

- CVSS Score: 6.1
- Enables clickjacking attacks

X-Content-Type-Options Missing:

- CVSS Score: 5.3
- Enables MIME type confusion attacks

```
**Current Response Headers:**
```
HTTP/1.1 302 Found
Date: Sun, 13 Jul 2025 03:37:05 GMT
Server: Apache/2.4.58 (Ubuntu)
Set-Cookie: security=impossible; path=/; HttpOnly
Set-Cookie: PHPSESSID=...; HttpOnly; SameSite=Strict
Location: login.php
```

**Missing Headers:**
- ❌ X-Frame-Options
- ❌ X-Content-Type-Options
- ❌ X-XSS-Protection
- ❌ Content-Security-Policy
- ❌ Strict-Transport-Security
```

Security Review – Nmap & Nikto

Risk High – “/server-status” (Exposure of Apache status page, risk of sensitive information leakage)

Risk medium – “X- Frame-options” (Implies that easy to be attacked by Clickjacking)

```
==> nmap
If using `ndiff` returns an error about not being able to import the ndiff module, try:
  chmod go-w /opt/homebrew/Cellar
suenzim@Alarics-MacBook-Pro ~ % nmap -sV -p- 3.144.192.224

Starting Nmap 7.97 ( https://nmap.org ) at 2025-07-12 19:23 -0700
Stats: 0:00:19 elapsed; 0 hosts completed (1 up), 1 undergoing Connect Scan
Connect Scan Timing: About 0.51% done
Stats: 0:00:20 elapsed; 0 hosts completed (1 up), 1 undergoing Connect Scan
Connect Scan Timing: About 0.55% done
Stats: 0:00:22 elapsed; 0 hosts completed (1 up), 1 undergoing Connect Scan
Connect Scan Timing: About 0.62% done
Stats: 0:00:23 elapsed; 0 hosts completed (1 up), 1 undergoing Connect Scan
Connect Scan Timing: About 0.66% done
Stats: 0:00:24 elapsed; 0 hosts completed (1 up), 1 undergoing Connect Scan
Connect Scan Timing: About 0.67% done
Stats: 0:00:24 elapsed; 0 hosts completed (1 up), 1 undergoing Connect Scan
Connect Scan Timing: About 0.69% done
Stats: 0:00:25 elapsed; 0 hosts completed (1 up), 1 undergoing Connect Scan
Connect Scan Timing: About 0.73% done
Stats: 0:00:25 elapsed; 0 hosts completed (1 up), 1 undergoing Connect Scan
Connect Scan Timing: About 0.74% done
Stats: 0:00:26 elapsed; 0 hosts completed (1 up), 1 undergoing Connect Scan
Connect Scan Timing: About 0.75% done
Stats: 0:01:43 elapsed; 0 hosts completed (1 up), 1 undergoing Connect Scan
Connect Scan Timing: About 3.56% done; ETC: 20:11 (0:46:32 remaining)
Stats: 0:02:41 elapsed; 0 hosts completed (1 up), 1 undergoing Connect Scan
Connect Scan Timing: About 5.67% done; ETC: 20:10 (0:44:40 remaining)
Stats: 0:06:30 elapsed; 0 hosts completed (1 up), 1 undergoing Connect Scan
Connect Scan Timing: About 12.91% done; ETC: 20:13 (0:43:51 remaining)
Stats: 0:07:44 elapsed; 0 hosts completed (1 up), 1 undergoing Connect Scan
Connect Scan Timing: About 14.98% done; ETC: 20:14 (0:43:47 remaining)
Stats: 0:26:45 elapsed; 0 hosts completed (1 up), 1 undergoing Connect Scan
Connect Scan Timing: About 53.22% done; ETC: 20:13 (0:23:31 remaining)
Stats: 0:27:14 elapsed; 0 hosts completed (1 up), 1 undergoing Connect Scan
Connect Scan Timing: About 53.72% done; ETC: 20:13 (0:23:28 remaining)
Nmap scan report for ec2-3-144-192-224.us-east-2.compute.amazonaws.com (3.144.192.224)
Host is up (0.075s latency).
Not shown: 65533 filtered tcp ports (no-response)
PORT   STATE SERVICE VERSION
22/tcp open  ssh     OpenSSH 9.6p1 Ubuntu 3ubuntu13.12 (Ubuntu Linux; protocol 2.0)
80/tcp open  http    Apache httpd 2.4.58
Service Info: Host: ip-172-31-36-115.us-east-2.compute.internal; OS: Linux; CPE: cpe:/o:linux:linux_kernel

Service detection performed. Please report any incorrect results at https://nmap.org/submit/ .
Nmap done: 1 IP address (1 host up) scanned in 3056.29 seconds
```

```
ubuntu@ip-172-31-88-226:/var/www/html/DVWA/config$ nikto -h http://localhost
- Nikto v2.1.5
---------------------------------------------------------------------------
+ Target IP:          127.0.0.1
+ Target Hostname:    localhost
+ Target Port:        80
+ Start Time:         2025-07-19 22:48:56 (GMT0)
---------------------------------------------------------------------------
+ Server: Apache/2.4.52 (Ubuntu)
+ Server leaks inodes via ETags, header found with file /, fields: 0x29af 0x63a4ea46921db
+ The anti-clickjacking X-Frame-Options header is not present.
+ No CGI Directories found (use '-C all' to force check all possible dirs)
+ Allowed HTTP Methods: POST, OPTIONS, HEAD, GET
+ OSVDB-561: /server-status: This reveals Apache information. Comment out appropriate line in httpd.conf or restrict access to
+ 6544 items checked: 0 error(s) and 4 item(s) reported on remote host
+ End Time:           2025-07-19 22:49:03 (GMT0) (7 seconds)
---------------------------------------------------------------------------
+ 1 host(s) tested
```

Vulnerability Severity Overview

Scan Results Summary

Tool	Finding	Details & Risk
Nmap	Open Port: 22/tcp	**Service:** OpenSSH 9.6p1 **Risk:** Standard for server management (SSH). Ensure it is protected with strong passwords or, preferably, SSH keys.
Nmap	Open Port: 80/tcp	**Service:** Apache httpd 2.4.58 **Risk:** Standard for web traffic (HTTP). The specific version is identified, which could help an attacker find known exploits.
Nikto	Server Version Leak	**Finding:** `Server: Apache/2.4.58` **Risk:** Confirms the Nmap finding. Publicly showing the exact server version makes it easier for attackers to find and use version-specific vulnerabilities.
Nikto	Missing Security Header	**Finding:** `The anti-clickjacking X-Frame-Options header is not present.` **Risk:** Your site is vulnerable to **Clickjacking** attacks, where an attacker can trick users into clicking on things they can't see.
Nikto	Allowed HTTP Methods	**Finding:** `Allowed HTTP Methods: POST, OPTIONS, HEAD, GET` **Risk:** Informational. This lists the acceptable request types. It's good that potentially dangerous methods like `PUT` or `DELETE` are not enabled.
Nikto	Server Status Leak	**Finding:** `OSVDB-561: /server-status` . **Risk:** If `mod_status` is enabled and misconfigured, the `/server-status` page could leak sensitive information about server performance, traffic, and active connections.

Vulnerability Summary – AWS Inspector

- AWS Inspector flagged ports 22 (SSH) and 80 (HTTP) as publicly accessible
- Severity levels: Medium (SSH) and Low (HTTP)
- Exposure type: Network Reachability

inspector-findings.md | Preview inspector-findings.md | nmap-scan.md | Remediation.md | severity-analysis.md | vulnerability-log.md

Step 5: Analyze Inspector Findings and Document Results

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Remediation Priority Plan

Phase 1: Harden Server and Header Configurations

- Implement Critical Security Headers
- Conceal Server Information
- Disable Directory Browse

Phase 2: Secure Application Logic and Session Management

- Fix Parameter Tampering
- Cookies

Phase 3: Review, Verify, and Document

- Re-Scan the Application
- Manual Verification
- Document and Report

Next Steps

Run additional vulnerability scans (OWASP ZAP, Nmap, Nikto)

Perform manual penetration testing

Use AWS Inspector for cloud-specific vulnerabilities

Implement remediation measures

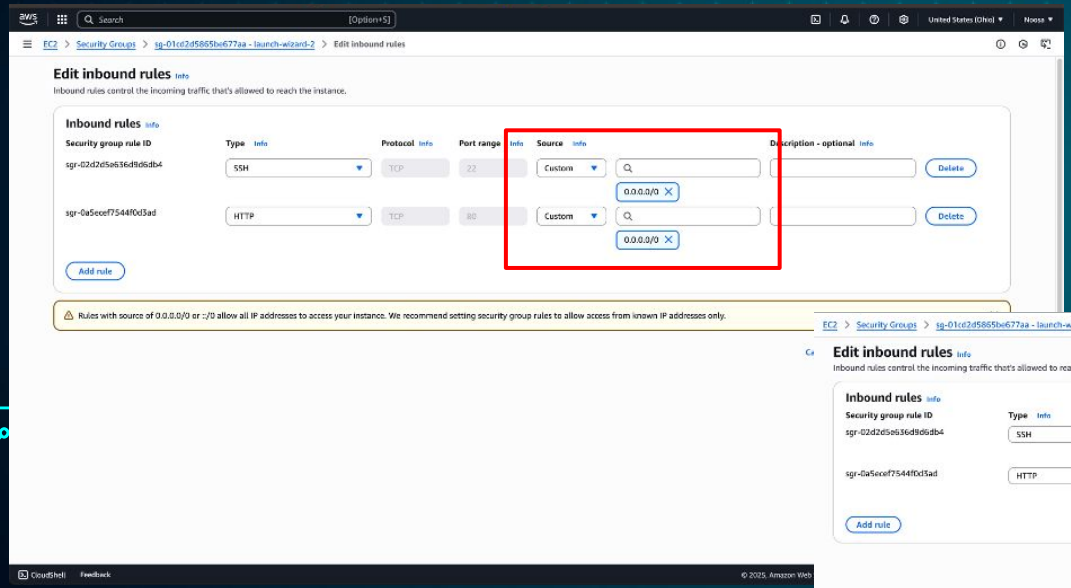
Re-scan to verify fixes

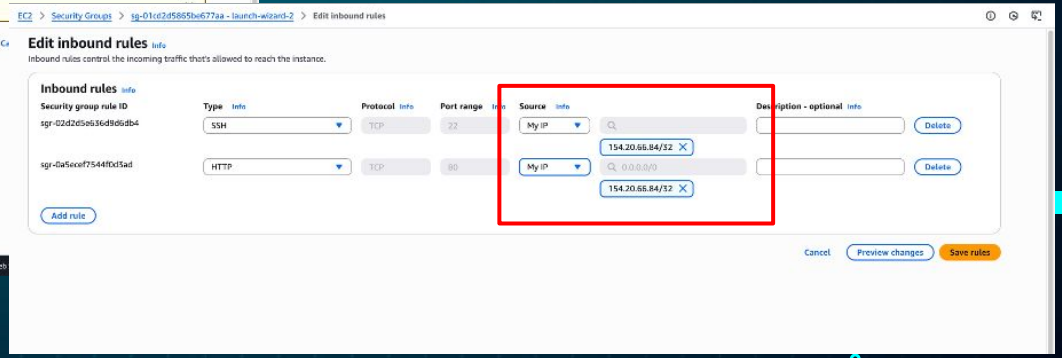
Remediation Implementation

1. Medium – Content Security Policy (CSP) Header Not Set
2. Medium – Directory Browsing
3. Medium – Parameter Tampering
4. Medium – Missing Anti-Clickjacking Header – In Apache doc add (Header always set X-Frame-Options "DENY")

Remediation & Implementation

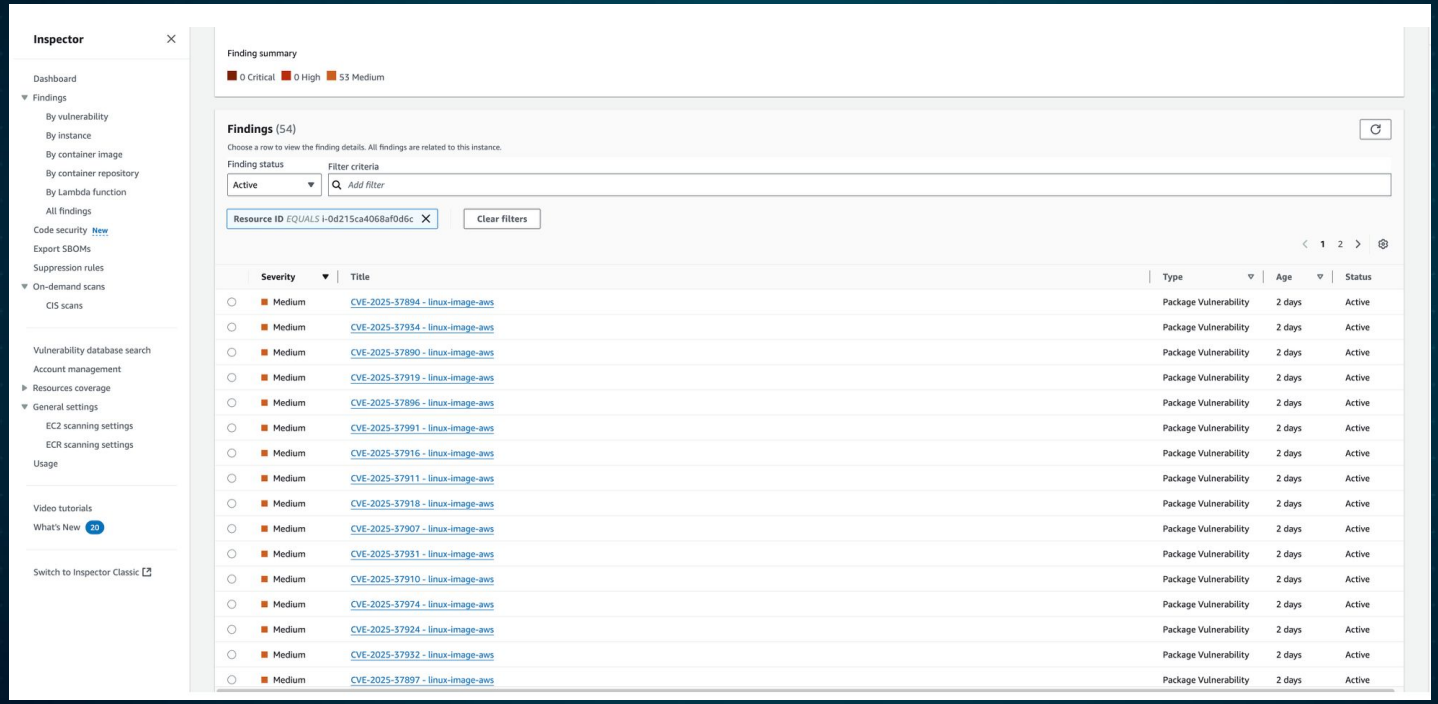
Vulnerability: Public SSH Access (Severity: High)





With this new rule, all SSH connection attempts from unknown sources will be blocked at the network level, and the corresponding "Network Reachability" finding in AWS Inspector would be resolved.

Fix verification scan report



Key Takeaways

✅ Security is a continuous process - Regular scanning is essential

✅ Common vulnerabilities are still prevalent

✅ Defense in depth - Multiple layers of security needed

✅ Automation helps - Tools like Nikto can quickly identify issues

Thank You