SECURITY ASSESSMENT REPORT

Task 3: Secure Coding Review
Target: Network Diagnostics API

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Status: FINAL

1. Executive Summary

A comprehensive security audit was conducted on the 'Network Diagnostics API'. The assessment followed a 'Test-Driven Security' methodology, combining static analysis with dynamic exploitation proof-of-concepts.

Vulnerability ID	Issue Type	Severity	Status
VULN-001	OS Command Injection	**CRITICAL (9.8)**	**REMEDIATED**

2. Methodology

The audit followed a four-step lifecycle:

1. Asset Creation: Deployed a local Flask API environment.
2. Assessment: Used 'Bandit' for static analysis and identified CWE-78.
3. Exploitation (Red Team): Developed a Python script to achieve Remote Code Execution (RCE).
4. Remediation (Blue Team): Implemented input allow-listing and secure subprocess execution.

3. Technical Findings & Evidence

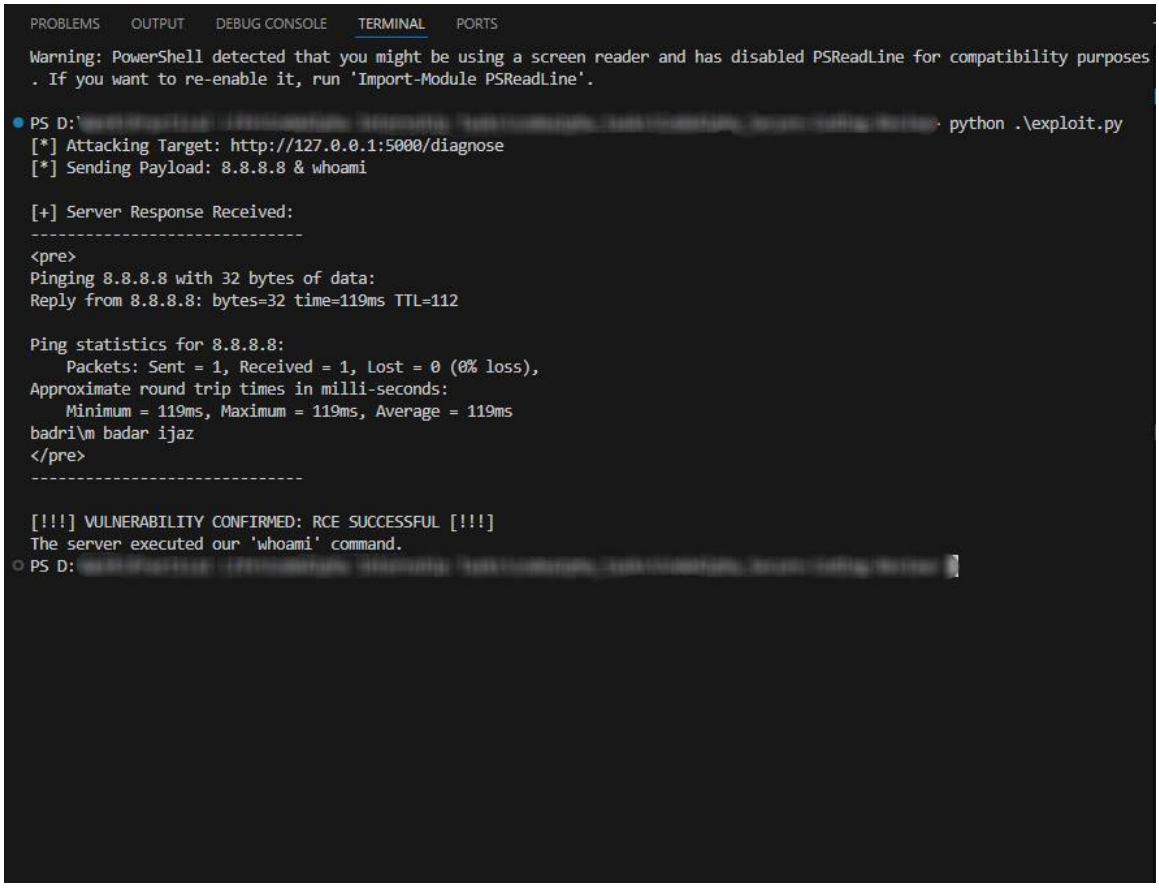
The application failed to sanitize user input before passing it to the system shell.

Vulnerable Code Snippet:

```
command = f"ping -n 1 {target_ip}"
subprocess.check_output(command, shell=True)
```

Proof of Concept (Evidence):

The following screenshot demonstrates the successful execution of the 'whoami' command via the exploit script:


PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
PORTS
Warning: PowerShell detected that you might be using a screen reader and has disabled PSReadLine for compatibility purposes
. If you want to re-enable it, run 'Import-Module PSReadLine'.
PS D:\ python .\exploit.py
[*] Attacking Target: http://127.0.0.1:5000/diagnose
[*] Sending Payload: 8.8.8.8 & whoami
[+] Server Response Received:
<pre>
Pinging 8.8.8.8 with 32 bytes of data:
Reply from 8.8.8.8: bytes=32 time=119ms TTL=112
Ping statistics for 8.8.8.8:
Packets: Sent = 1, Received = 1, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 119ms, Maximum = 119ms, Average = 119ms
badri\m badar ijaz
</pre>
[!!!] VULNERABILITY CONFIRMED: RCE SUCCESSFUL [!!!]
The server executed our 'whoami' command.
PS D:

4. Remediation Strategy

The vulnerability was patched by implementing two controls:

- 1. Disabled Shell Execution (shell=False).
- 2. Implemented strict Allow-List Input Validation.

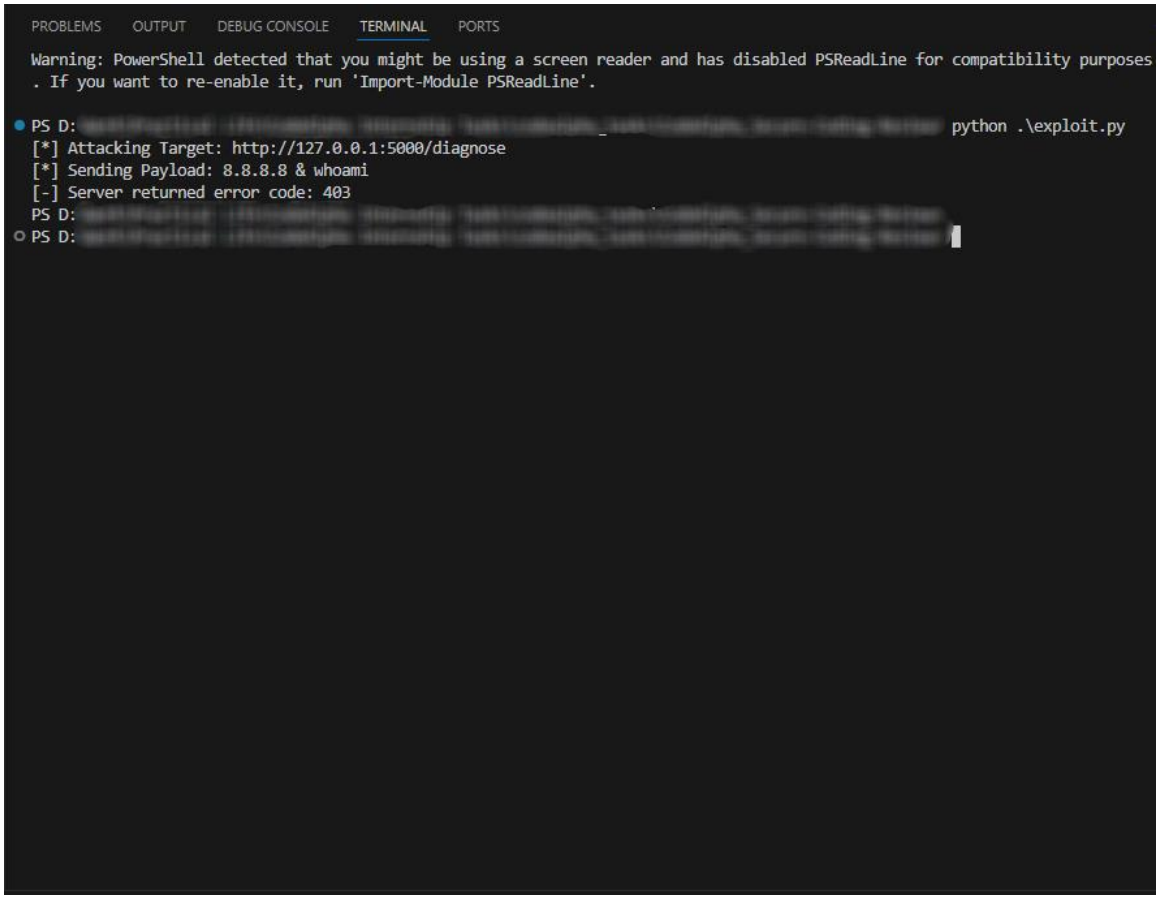
Secure Code Implementation:

```
# 1. Validation
allowed = set("abcdefghijklmnopqrstuvwxyz0123456789.-")
if not set(ip).issubset(allowed): abort(403)

# 2. Secure Execution (List format)
subprocess.check_output(["ping", "-n", "1", ip], shell=False)
```

5. Verification (Regression Test)

The exploit script was re-executed against the patched server. The server correctly identified the malicious payload and blocked the request (HTTP 403).



Conclusion

The security assessment identified a critical OS Command Injection vulnerability (CWE-78) within the Network Diagnostics API, which allowed remote command execution. Through secure coding practices, including strict input validation and the removal of shell-based command execution, the vulnerability was successfully remediated.

Post-remediation verification confirmed that the exploit was no longer effective and malicious input was correctly rejected. The application now adheres to secure subprocess execution principles and demonstrates improved resilience against command injection attacks.