

2. API Security Testing Lab – Theory & Practical Context

Overview of API Security Testing (Theory)

Application Programming Interfaces (APIs) act as the backbone of modern web and mobile applications by enabling communication between services. Due to their direct access to business logic and sensitive data, APIs are a prime target for attackers. API security testing focuses on identifying weaknesses related to authentication, authorization, input validation, and improper configuration.

The **OWASP API Top 10** provides a standardized list of the most critical API security risks, such as Broken Object Level Authorization (BOLA), Injection flaws, Excessive Data Exposure, and Security Misconfiguration. Testing APIs against these risks ensures that access control and data handling mechanisms are implemented securely.

Tools Used:

- **Burp Suite** is used as an intercepting proxy to analyze and manipulate API requests in real time. It helps testers observe headers, tokens, parameters, and responses.
- **Postman** is used for crafting and sending API requests manually, making it ideal for testing REST and GraphQL APIs.
- **sqlmap** automates detection and exploitation of SQL injection vulnerabilities using captured API requests.

Using these tools together enables both **manual testing** (logic flaws, authorization issues) and **automated testing** (injection vulnerabilities).

1. Test Setup: DVWA API for OWASP API Top 10 Issues

Prerequisites:

- DVWA installed and running (e.g., at <http://192.168.0.102/dvwa>).
- Burp Suite configured as a proxy (default: 127.0.0.1:8080).
- Postman set to use Burp Suite as a proxy.

Theory Context:

DVWA (Damn Vulnerable Web Application) provides intentionally insecure endpoints that simulate real-world API vulnerabilities. Testing on DVWA allows security professionals to safely practice exploitation techniques while understanding root causes and impact.

Steps:

1. Configure DVWA Security:

Setting the security level to “Low” removes defensive controls, allowing vulnerabilities to be tested clearly and consistently.

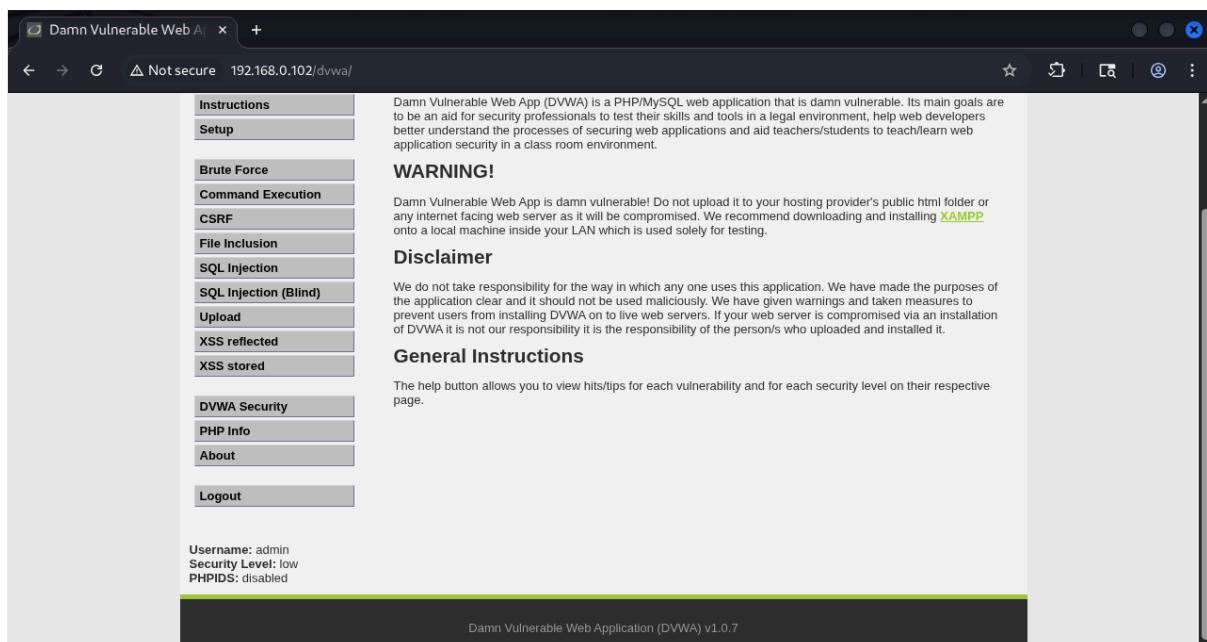


Figure 1: DVWA



Burp Suite Community Edition v2025.7.4 - Temporary Project

Dashboard Target Proxy Intruder Repeater View Help

Intercept **HTTP history** WebSockets history Match and replace Proxy settings

Filter settings: Hiding CSS, Image and general binary content

	Method	URL	Params	Edited	Status code	Length	MIME type	Extension	Title	Notes	TLS	IP	Cookies	Time	Listener port	Start response
192.168.0.102	GET	/			200	1124	HTML		Metasploitable2 - Linux		192.168.0.102			16:02:22 25 ...	8080	5
192.168.0.102	GET	/favicon.ico			404	515	HTML	ico	404 Not Found		192.168.0.102			16:02:22 25 ...	8080	
192.168.0.102	GET	/dvwal			302	482	HTML				192.168.0.102			16:02:25 25 ...	8080	6
192.168.0.102	GET	/dvwaflogin.php			200	1636	HTML	php	Damm Vulnerable We...		192.168.0.102			16:02:25 25 ...	8080	7
192.168.0.102	POST	/dvwaflogin.php	✓		302	392	HTML	php	Damm Vulnerable We...		192.168.0.102			16:02:31 25 ...	8080	7
192.168.0.102	GET	/dvwafindex.php			200	4932	HTML	php	Damm Vulnerable We...		192.168.0.102			16:02:31 25 ...	8080	6
192.168.0.102	GET	/dvwadwvaf/dwvaPage.js			200	1087	script	js			192.168.0.102			16:02:31 25 ...	8080	1
192.168.0.102	GET	/dvwalsecurity.php			200	4453	HTML	php	Damm Vulnerable We...		192.168.0.102			16:02:37 25 ...	8080	84
192.168.0.102	GET	/dvwalsecurity.php			200	4453	HTML	php	Damm Vulnerable We...		192.168.0.102			16:02:37 25 ...	8080	71
192.168.0.102	POST	/dvwalsecurity.php	✓		302	426	HTML	php	Damm Vulnerable We...		192.168.0.102		security=low	16:02:40 25 ...	8080	7
192.168.0.102	GET	/dvwalsecurity.php			200	4534	HTML	php	Damm Vulnerable We...		192.168.0.102			16:02:40 25 ...	8080	7
192.168.0.102	GET	/dvwal			200	4844	HTML		Damm Vulnerable We...		192.168.0.102			16:02:44 25 ...	8080	6
192.168.0.102	GET	/dvwal/			200	4844	HTML		Damm Vulnerable We...		192.168.0.102			16:02:44 25 ...	8080	9

Request

Pretty	Raw	Hex
1 GET /dvwalsecurity.php HTTP/1.1 2 Host: 192.168.0.102 3 Connection: keep-alive 4 Accept: */* 5 Upgrade-Insecure-Requests: 1 6 User-Agent: Mozilla/5.0 (X11; Linux x86_64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/139.0.0.0 Safari/537.36 7 Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/avif,image/webp,image/apng,*/*;q=0.8,application/signed-exchange;v=b3;q=0.7 8 Cache-Control: max-age=0 9 Accept-Encoding: gzip, deflate, br 10 Cookie: security=low PHPSESSID=a876a8d5balclf449e22292a0f0a02c7 11 Connection: keep-alive 12 13 14 <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN" 15 "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd"> 16 <html xmlns="http://www.w3.org/1999/xhtml">		

Response

Pretty	Raw	Hex	Render
1 HTTP/1.1 200 OK 2 Date: Thu, 25 Jul 2025 10:33:44 GMT 3 Server: Apache/2.4.2-2ubuntu0.10 4 X-Powered-By: PHP/5.2.4-2ubuntu0.10 5 Pragma: no-cache 6 Cache-Control: no-cache, must-revalidate 7 Expires: Tue, 23 Jun 2009 12:00:00 GMT 8 Content-Length: 4187 9 Keep-Alive: timeout=15, max=98 10 Connection: Keep-Alive 11 Content-Type: text/html; charset=utf-8 12 13 14 <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN" 15 "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd"> 16 <html xmlns="http://www.w3.org/1999/xhtml">			

Inspector

Request attributes	2

Notes

Event log (1) All issues

Memory: 120.6MB Disabled

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7	http://192.168.0.102	GET	/dvwadwvaf/dwvaPage.js			200	1087	script	js			192.168.0.102			16:02:31 25 ...	8080	
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9	http://192.168.0.102	GET	/dvwalsecurity.php			200	4453	HTML	php	Damm Vulnerable We...		192.168.0.102			16:02:37 25 ...	8080	
10	http://192.168.0.102	POST	/dvwalsecurity.php	✓		302	426	HTML	php	Damm Vulnerable We...		192.168.0.102		security=low	16:02:40 25 ...	8080	
11	http://192.168.0.102	GET	/dvwalsecurity.php			200	4534	HTML	php	Damm Vulnerable We...		192.168.0.102			16:02:40 25 ...	8080	
12	http://192.168.0.102	GET	/dvwal			200	4844	HTML		Damm Vulnerable We...		192.168.0.102			16:02:44 25 ...	8080	
13	http://192.168.0.102	GET	/dvwal/			200	4844	HTML		Damm Vulnerable We...		192.168.0.102			16:02:44 25 ...	8080	

Event log (1) All issues

Memory: 120.7MB Disabled

Figure 2: Burpsuite

2. Map API Endpoints:

API enumeration is a crucial reconnaissance phase. Attackers often discover undocumented endpoints that expose sensitive functionality.



- a. Use Burp Suite's "Crawler" tool to discover API endpoints (e.g., /api/users, /graphql).

The screenshot shows the Burp Suite interface with the 'Target' tab selected. On the left, a tree view displays the crawled sitemap for the host 192.168.0.102, including paths like /, /dav, /dwva, /login.php, /logout.php, /phpinfo.php, /security.php, and /setup.php. On the right, a table lists the discovered endpoints with columns for Host, Method, URL, Params, Status code, Length, MIME type, Title, Notes, and Time requested. Below the table, the 'Request' and 'Response' panes show a specific request to /login.php with a POST payload containing 'username=admin&password=password'. The response is an HTTP/1.1 200 OK status with a Content-Type of text/html, returning an XML response. The 'Inspector' pane shows the raw request and response headers.

Figure 3: Sitemap crawled of DVWA

3. Test for BOLA (Broken Object Level Authorization):

BOLA occurs when APIs rely solely on user-supplied identifiers without verifying ownership. This allows attackers to access other users' data by manipulating object IDs.

- a. Send a request to /api/users/1 with your token.
- b. Modify the user ID to 2 or 3 in Burp Repeater.
- c. If you can access another user's data, BOLA is confirmed.

4. Test for GraphQL Injection:

GraphQL APIs are vulnerable when introspection and input validation are improperly configured. Attackers can enumerate schemas or inject malicious queries to extract sensitive information.

- a. Use Postman to send a GraphQL query to /graphql.
- b. Inject malicious payloads like { __schema{types{name}} } to test for introspection flaws.
- c. Use Burp Suite's "GraphQL" tab for easier manipulation.

2. Logging Findings

Proper logging ensures findings are traceable, reproducible, and actionable. Each vulnerability is assigned a unique ID, severity, and affected endpoint to support remediation and risk assessment.

Test ID	Vulnerability	Severity	Target Endpoint
001	BOLA	Critical	/api/users
002	GraphQL Injection	High	/graphql

3. Manual API Testing Using Burp Suite

Manual testing is essential for identifying **business logic flaws** that automated tools often miss.

Theory Context:

- API tokens (JWT, Bearer tokens) define user identity and access scope.
- Improper token validation leads to privilege escalation and unauthorized access.

Steps:

1. Intercept API requests to analyze headers and parameters.
2. Modify or remove authorization tokens to test access controls.
3. Fuzz input parameters to identify injection flaws and error-based responses.

4. Checklist-Based Testing Approach (Theory)

A checklist ensures comprehensive coverage of API attack surfaces and reduces the risk of missing critical vulnerabilities.

Checklist:

- Enumerate API endpoints using Burp Spider and Postman
- Test for BOLA using Burp Suite
- Fuzz GraphQL queries using Postman
- Test for SQL injection with sqlmap
- Validate authentication and authorization mechanisms

5. Summary Writing

A concise summary communicates technical findings to both technical and non-technical stakeholders. It highlights risk, impact, and remediation without excessive detail.

API Test Summary:

Tested DVWA API for OWASP Top 10 issues. Identified Broken Object Level Authorization in /api/users and GraphQL injection in /graphql. Burp Suite enabled manual token manipulation, while Postman facilitated query testing. Proper authorization checks, input validation, and access controls are recommended.

Security Impact & Remediation

Unsecured APIs can result in data breaches, account takeovers, and full backend compromise. Implementing strict authorization checks, disabling GraphQL introspection in production, validating inputs, and monitoring API traffic significantly reduces attack surface.

Citations

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