Basic Principles and Resources

Saltzer & Schröder, IEEE CSD,
OWASP Top 10 / STG / ASVS

Rough Overview

1. Introduction
2. >> Basic Principles and Resources <<
3. Architecture & Basic Web Procedure
4. Authentication and Session Management
5. Authorization
6. Server and Backend Attacks
7. Remaining Client Attacks
8. General Topics
9. Conclusions

There are a few basic principles that apply to almost all vulnerabilities

Economy of Mechanism

Fail-safe Defaults

Complete Mediation

Least Privilege

Least Common Mechanism

Separation of Privilege

Open Design

Psychological Acceptability

- Saltzer and Schroeder, 1975 –

http://web.cs.wpi.edu/~guttman/cs557_website/papers/saltzer1975.pdf
https://adam.shostack.org/blog/the-security-principles-of-saltzer-and-schroeder/

Earn or give, but never assume, trust.

Use an authentication mechanism that cannot be bypassed or tampered with.

Authorize after you authenticate

Strictly separate data and control instructions, and never process control instructions received from untrusted sources.

Define an approach that ensures all data are explicitly validated.

Use cryptography correctly.

Identify sensitive data and how they should be handled.

Always consider the user.

Understand how integrating external components changes your attack surface.

Be flexible when considering future changes to objects and actors.

- IEEE Center for Secure Design, 2014 –

https://ieeecs-media.computer.org/media/technical-activities/CYBSI/docs/Top-10-Flaws.pdf

Some resources which might be useful…

OWASP
(Open Web Application Security Project)

OWASP Top 10

OWASP Top 10 - 2013	→	OWASP Top 10 - 2017
A1 – Injection	→	A1:2017-Injection
A2 – Broken Authentication and Session Management	→	A2:2017-Broken Authentication
A3 – Cross-Site Scripting (XSS)	↘	A3:2017-Sensitive Data Exposure
A4 – Insecure Direct Object References [Merged+A7]	U	A4:2017-XML External Entities (XXE) [NEW]
A5 – Security Misconfiguration	↘	A5:2017-Broken Access Control [Merged]
A6 – Sensitive Data Exposure	↗	A6:2017-Security Misconfiguration
A7 – Missing Function Level Access Contr [Merged+A4]	U	A7:2017-Cross-Site Scripting (XSS)
A8 – Cross-Site Request Forgery (CSRF)	☒	A8:2017-Insecure Deserialization [NEW, Community]
A9 – Using Components with Known Vulnerabilities	→	A9:2017-Using Components with Known Vulnerabilities
A10 – Unvalidated Redirects and Forwards	☒	A10:2017-Insufficient Logging&Monitoring [NEW,Comm.]

https://owasp.org/www-project-top-ten/

OWASP ASVS

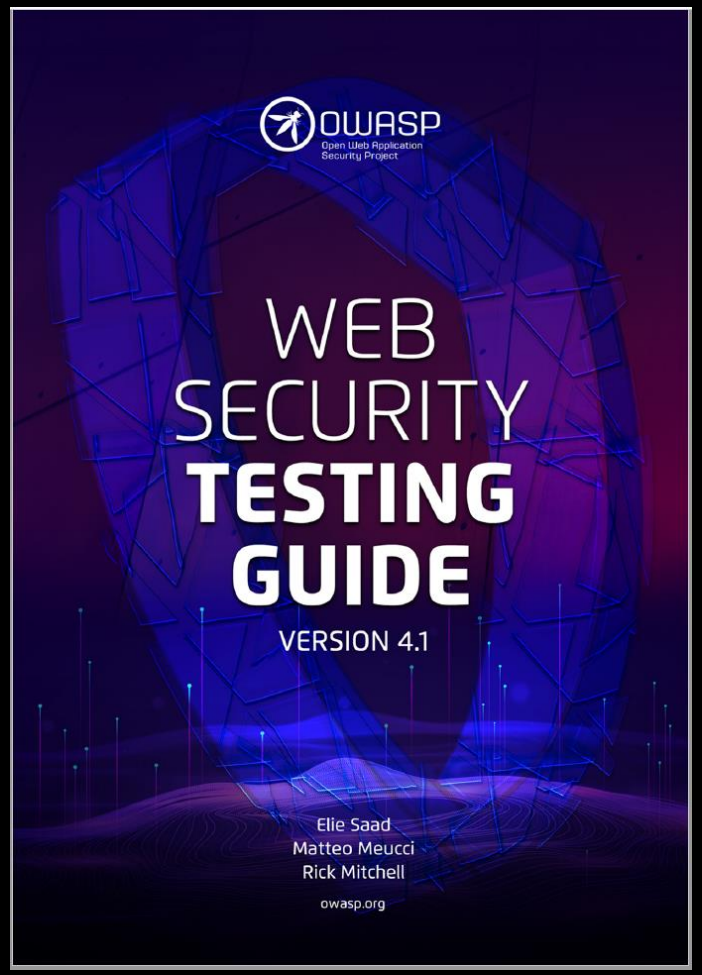
V1: Architecture, Design and Threat Modeling Requirements
V2: Authentication Verification Requirements
V3: Session Management Verification Requirements
V4: Access Control Verification Requirements
V5: Validation, Sanitization and Encoding Verification Requirements
V6: Stored Cryptography Verification Requirements
V7: Error Handling and Logging Verification Requirements
V8: Data Protection Verification Requirements
V9: Communications Verification Requirements
V10: Malicious Code Verification Requirements
V11: Business Logic Verification Requirements
V12: File and Resources Verification Requirements
V13: API and Web Service Verification Requirements
V14: Configuration Verification Requirements

V3.2 Session Binding Requirements

#	Description	L1	L2	L3	CWE	NIST §
3.2.1	Verify the application generates a new session token on user authentication. (C6)	✓	✓	✓	384	7.1
3.2.2	Verify that session tokens possess at least 64 bits of entropy. (C6)	✓	✓	✓	331	7.1
3.2.3	Verify the application only stores session tokens in the browser using secure methods such as appropriately secured cookies (see section 3.4) or HTML 5 session storage.	✓	✓	✓	539	7.1
3.2.4	Verify that session token are generated using approved cryptographic algorithms. (C6)		✓	✓	331	7.1

https://owasp.org/www-project-application-security-verification-standard/

OWASP Web Security Testing Guide



https://owasp.org/www-project-web-security-testing-guide/

Some more interesting resources

- Similar courses from other universities
  - Feross Aboukhadijeh (Stanford)
    - https://web.stanford.edu/class/cs253/
  - Andreas Happe (FH/Technikum Wien)
    - https://snikt.net/WebSec.pdf
  - Björn Kimminich
    - https://github.com/bkimminich/it-security-lecture
- PortSwigger Web Security Academy
  - https://portswigger.net/web-security
- Hacker101
  - https://www.hacker101.com/

Key Messages

- Sticking to a few design principles helps to avoid a lot of flaws and vulnerabilities
  - they also help to find flaws and vulnerabilities
- A lot of great resources are available when it comes to web security
- OWASP is your friend