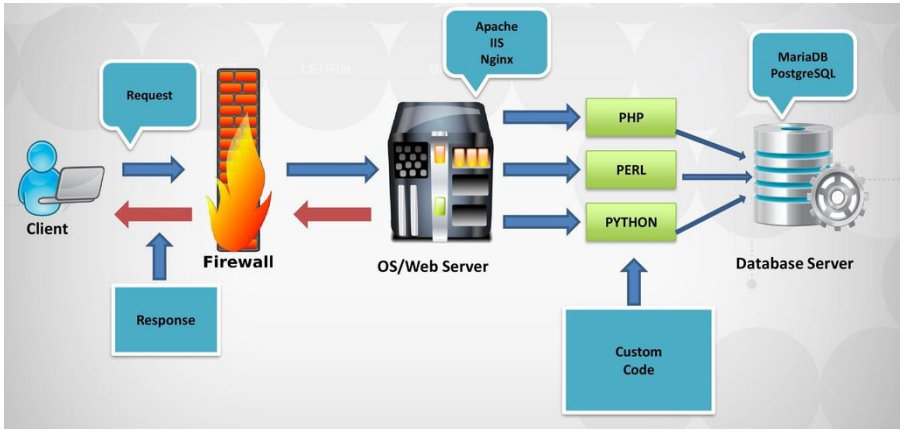
STI
MEI/MIEBIOM
2022/2023

Practical class #7

- **Web application security with OWASP ZAP and Kali**

Web Application Security

- Web application security is a central component of any web-based business
- Web applications expose web properties to attack from different locations and various levels of scale and complexity
- Web application security deals with the security surrounding websites, web applications and web services



From https://owasp.org/

Main Web Application Security Risks (1)

- Cross-Site Scripting XSS
  - XSS flaws occur whenever an application includes untrusted data in a new web page without proper validation or escaping, or updates an existing web page with user-supplied data using a browser API that can create HTML or JavaScript. XSS allows attackers to execute scripts in the victim's browser which can hijack user sessions, deface web sites, or redirect the user to malicious sites.

- Injection
  - Injection flaws, such as SQL, NoSQL, OS, and LDAP injection, occur when untrusted data is sent to an interpreter as part of a command or query. The attacker's hostile data can trick the interpreter into executing unintended commands or accessing data without proper authorization.

- Broken Authentication
  - Application functions related to authentication and session management are often implemented incorrectly, allowing attackers to compromise passwords, keys, or session tokens, or to exploit other implementation flaws to assume other users' identities temporarily or permanently.

- Broken Access Control
  - Restrictions on what authenticated users are allowed to do are often not properly enforced. Attackers can exploit these flaws to access unauthorized functionality and/or data, such as access other users' accounts, view sensitive files, modify other users' data, change access rights, etc.

From https://owasp.org/

Main Web Application Security Risks (2)

- Sensitive Data Exposure
  - Many web applications and APIs do not properly protect sensitive data, such as financial, healthcare, and PII. Attackers may steal or modify such weakly protected data to conduct credit card fraud, identity theft, or other crimes. Sensitive data may be compromised without extra protection, such as encryption at rest or in transit, and requires special precautions when exchanged with the browser.
- Security Misconfiguration
  - Security misconfiguration is the most commonly seen issue, commonly a result of insecure default configurations, incomplete or ad hoc configurations, open cloud storage, misconfigured HTTP headers, and verbose error messages containing sensitive information.
- Using Components with Known Vulnerabilities
  - Components, such as libraries, frameworks, and other software modules, run with the same privileges as the application. If a vulnerable component is exploited, such an attack can facilitate serious data loss or server takeover.
- Insecure Deserialization
  - Insecure deserialization often leads to remote code execution. Even if deserialization flaws do not result in remote code execution, they can be used to perform attacks, including replay attacks, injection attacks, and privilege escalation attacks.

From https://owasp.org/

OWASP

- The Open Web Application Security Project (OWASP) is a nonprofit foundation that works to improve the security of software

- Highlights:
  - Community-led open source software projects
  - Over 275 local chapters worldwide
  - Tens of thousands of members
  - Industry-leading educational and training conferences

- Open community dedicated to enabling organizations to conceive, develop, acquire, operate, and maintain applications that can be trusted

- All projects, tools, documents, forums, and chapters are free and open to anyone interested in improving application security

From https://owasp.org/

Web Security Testing Guide (WSTG) Project

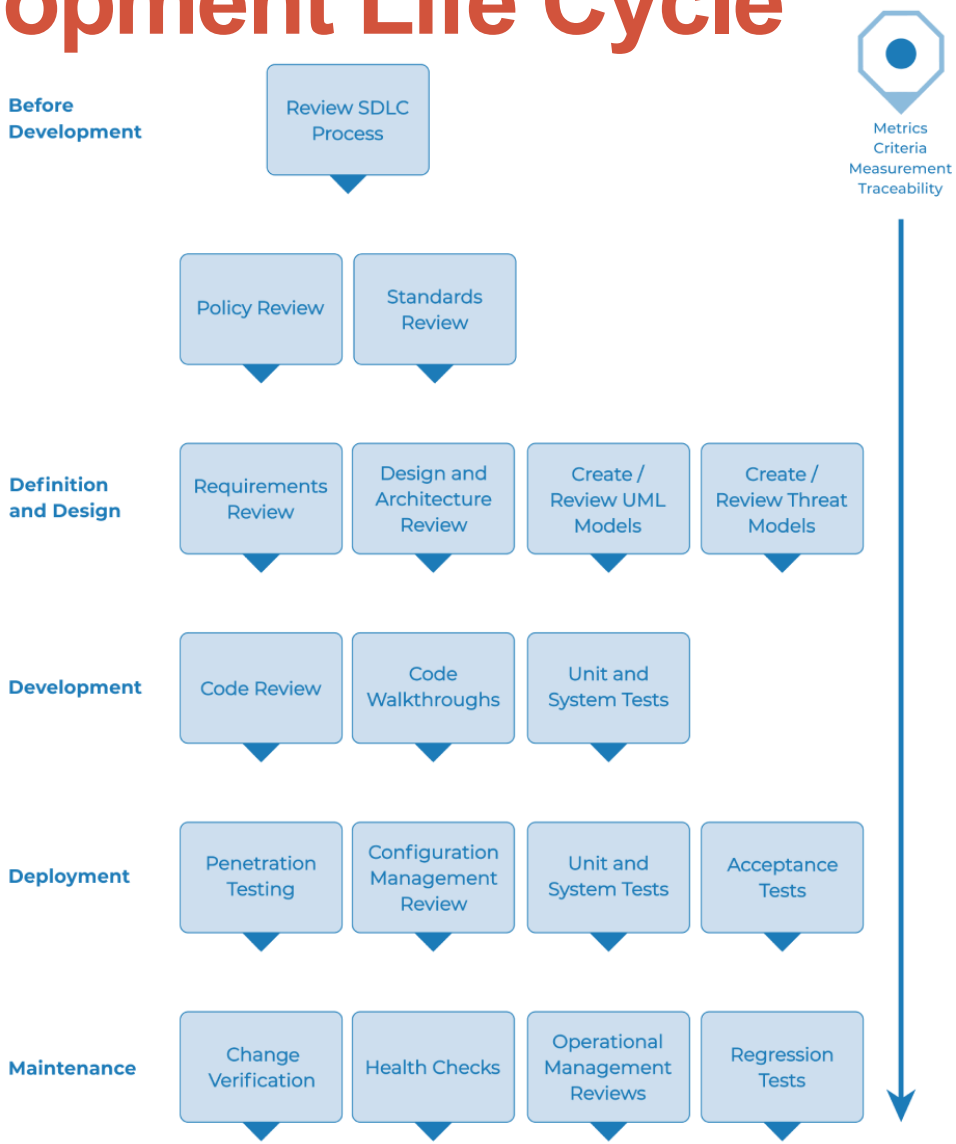
- The WSTG is a comprehensive guide to testing the security of web applications and web services
- Created by the collaborative efforts of security professionals and dedicated volunteers
- WSTG provides a framework of best practices used by penetration testers and organizations all over the world

https://github.com/OWASP/wstg/tree/master/document

From https://owasp.org/

Software Development Life Cycle

OWASP Testing Workflow

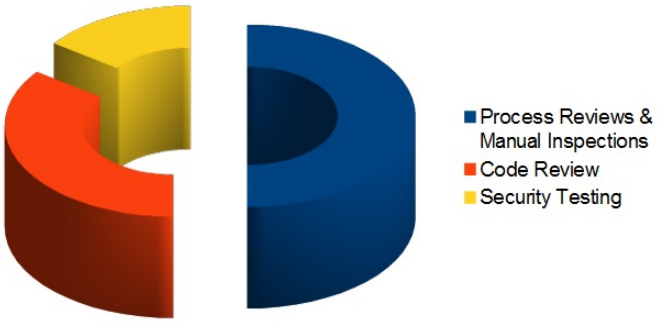


From https://owasp.org/

WSTG Project

4. Web Application Penetration Testing

- 4.1 Information Gathering
- 4.2 Configuration and Deployment Management Testing
- 4.3 Identity Management Testing
- 4.4 Authentication Testing
- 4.5 Authorization Testing
- 4.6 Session Management Testing
- 4.7 Input Validation Testing
- 4.8 Error Handling
- 4.9 Cryptography
- 4.10 Business Logic Testing
- 4.11 Client Side Testing



From https://owasp.org/

Security approaches

- Black box testing
  - Tools such as Web application security scanners, vulnerability scanners and penetration testing software
- White box testing
  - Tools such as static source code analyzers
- Fuzzing
  - Tools used for input testing
- Web application security scanner
  - Vulnerability scanner
- Web application firewalls (WAF)
  - Used to provide firewall-type protection at the web application layer
- Password cracking tools
  - For testing password strength and implementation

Black-Box Testing Tools

Some examples

- General Testing
  - OWASP ZAP
  - Burp Proxy
  - Webstretch Proxy
  - W3af
  - Subgraph Vega

- Commercial
  - NGS Typhon
  - IBM AppScan
  - Burp Intruder
  - Acunetix Web Vulnerability Scanner
  - MaxPatrol Security Scanner
  - Parasoft SOAtest (more QA-type tool)
  - N-Stalker Web Application Security Scanner
  - SoapUI (Web Service security testing)
  - Netsparker
  - SAINT
  - QualysGuard WAS
  - IndusGuard Web

- Linux Distribution
  - PenTestBox
  - Samurai
  - Santoku
  - ParrotSecurity
  - **Kali**
  - Matriux
  - BlackArch
  - PenToo

- Source Code Analyzers
  - Spotbugs
  - Find Security Bugs
  - FlawFinder
  - phpcs-security-audit
  - PMD
  - Microsoft's FxCop
  - Oedipus
  - Splint
  - SonarQube
  - W3af

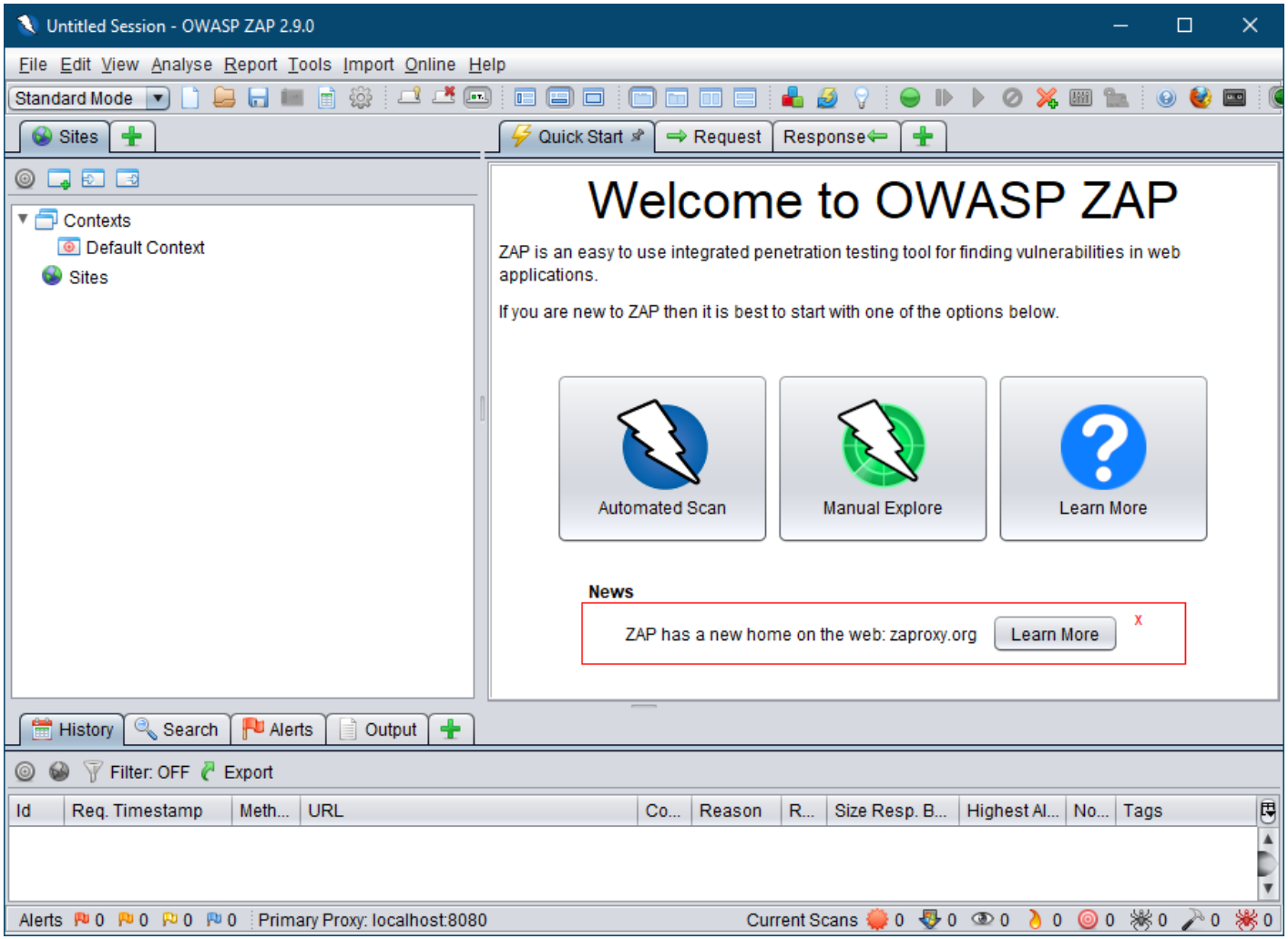
Full OWASP list: https://github.com/OWASP/wstg/blob/master/document/Appx.A_Testing_Tools_Resource/README.md

OWASP ZAP

- Zed Attack Proxy (ZAP) is a free, open-source penetration testing tool
- Maintained under the umbrella of the OWASP
- ZAP is designed specifically for testing web applications
- ZAP is a man-in-the-middle proxy
  - ZAP stands between the tester's browser and the web application so that it can intercept and inspect messages sent between browser and web application, modify the contents if needed, and then forward those packets on to the destination

https://www.zaproxy.org/

OWASP ZAP


Untitled Session - OWASP ZAP 2.9.0
File Edit View Analyse Report Tools Import Online Help
Standard Mode
Sites
Quick Start
Request
Response
Contexts
Default Context
Sites
Welcome to OWASP ZAP
ZAP is an easy to use integrated penetration testing tool for finding vulnerabilities in web applications.
If you are new to ZAP then it is best to start with one of the options below.
Automated Scan
Manual Explore
Learn More
News
ZAP has a new home on the web: zaproxy.org
Learn More
History
Search
Alerts
Output
Filter: OFF
Export
Id
Req. Timestamp
Meth...
URL
Co...
Reason
R...
Size Resp. B...
Highest Al...
No...
Tags
Alerts
Primary Proxy: localhost:8080
Current Scans

Kali Linux

KALI
BY OFFENSIVE SECURITY

- Kali Linux is a Debian-based Linux distribution aimed at advanced Penetration Testing and Security Auditing

- Kali contains several hundred tools which are geared towards various information security tasks, such as:
  - Penetration Testing
  - Security research
  - Computer Forensics
  - Reverse Engineering

- Kali Linux is an open source project that is specifically tailored to the needs of penetration testing professionals

https://www.kali.org/

STARTING THE EXERCISE

Exercise with OWASP ZAP

- Install OWASP ZAP:
  - https://www.zaproxy.org/download/
- To start testing use: Automated Scan

- More information is available at:
  - https://www.zaproxy.org/getting-started/
- Analyse results and conduct exploitation of identified threats

Exercise with Kali Linux

Exercise with Kali

- Install Kali (in a VM):
  - https://www.kali.org/get-kali/#kali-virtual-machines
- To start testing use tools available in the kali-tools-web package
- Use the documentation for each tools (kali tools)
  - burpsuite
  - wpscan
  - wapiti

apache-users	apache2	beef-xss
burpsuite	cadaver	commix
cutycapt	davtest	default-mysql-server
dirb	dirbuster	dotdotpwn
eyewitness	ftester	hamster-sidejack
heartleech	httprint	httrack
hydra	hydra-gtk	jboss-autopwn
joomscan	jsql-injection	laudanum
lbd	maltego	medusa
mitmproxy	ncrack	nikto
nishang	nmap	oscanner
owasp-mantra-ff	padbuster	paros
patator	php	php-mysql
plecost	proxychains4	proxytunnel
qsslcaudit	redsocks	sidguesser
siege	skipfish	slowhttptest
sqldict	sqlitebrowser	sqlmap
sqlninja	sqlsus	ssldump
sslh	sslscan	sslsniff
sslsplit	sslyze	stunnel4
thc-ssl-dos	tlssled	tnscmd10g
uniscan	wafw00f	wapiti
watobo	webacoo	webscarab
webshells	weevely	wfuzz
whatweb	wireshark	wpscan
xsser	zaproxy	

Altoro Mutual (demo site)

Not Secure | demo.testfire.net

AltoroMutual

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- Loan Products
- Cards
- Investments & Insurance
- Other Services

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- Lending Services
- Cards
- Insurance
- Retirement
- Other Services

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- Careers
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This web application is open source! *Get your copy from GitHub and take advantage of advanced features*