



# CONTINUOUS SECURITY: INTEGRATE SECURITY INTO YOUR DEVOPS PIPELINES

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<https://github.com/BillDinger/ContinuousSecurity>

# SECURITY LAPSES RUIN CUSTOMERS TRUST IN YOU

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*I am rugged and, more importantly, my code is rugged.*

*I recognize that software has become a foundation of our modern world.*

*I recognize the awesome responsibility that comes with this foundational role.*

*I recognize that my code will be used in ways I cannot anticipate, in ways it was not designed, and for longer than it was ever intended.*

*I recognize that my code will be attacked by talented and persistent adversaries who threaten our physical, economic, and national security.*

*I recognize these things - and I choose to be rugged.*

*I am rugged because I refuse to be a source of vulnerability or weakness.*

*I am rugged because I assure my code will support its mission.*

*I am rugged because my code can face these challenges and persist in spite of them.*

*I am rugged, not because it is easy, but because it is necessary and I am up for the challenge.*

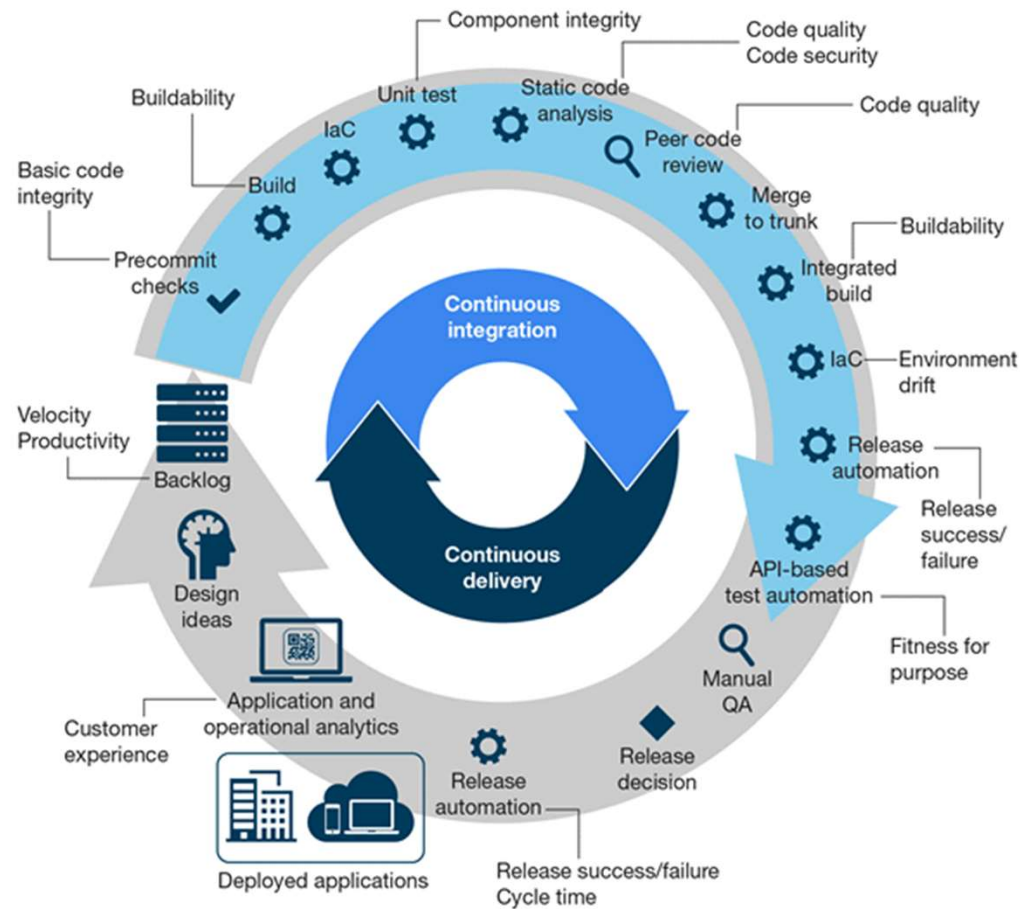
# SHIFT LEFT: TEST EARLY & TEST OFTEN

*“Another finding in our research is that teams that build security into their work also do better at continuous delivery [...] When the tools provided actually make life easier for the engineers who use them, they will adopt them of their own free will.”*

*“We found that high performers were spending 50% less time remediating security issues than low performers. In other words, by building security into their daily work, as opposed to retrofitting security concerns at the end, they spent significantly less time addressing security issues.”*

*Accelerate – Nicole Forsgren, Jez Humble & Gene Kim*

# BRIDGING THE GAP



# COUPLE ASSUMPTIONS...

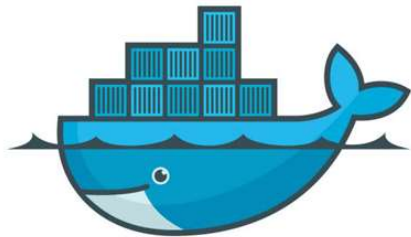
 Bitbucket



JavaScript



**Jenkins**



**docker**



**Java**<sup>™</sup>

# WHAT IS OWASP?

- **Open Web Application Security Project** – a 501(c)(3) focused on developing and improving the security of software
- Formed in 2001, its core purpose is to “Be the thriving global community that drives visibility and evolution in the safety and security of the world’s software”
- Provides numerous resources besides the OWASP Top 10, including personal favorites such as the Cheat Sheet Series, SAMM Project and Zap Attack Proxy Project



# OUR TOOLS

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## Code:

Dependency Check

Zed Attack proxy (ZAP)

Open Web Testing Framework (OWTF)

Web Testing Environments (WTE)

Sonarqube Rules

## Documentation:

Application Security Verification Standard



# OWASP DEPENDENCY CHECK



# OWASP DEPENDENCY CHECK

## Benefits

Protects against the OWASP #9 – using components with known security vulnerabilities automatically as part of your build and CI pipeline.

## How it works

Scans dependencies and compares them against the NIST National Vulnerability Database (NVD) for any posted CVEs. Supports suppression lists, report generation, failure depending on severity, etc.

## Implementations

- Java & .NET are officially supported.
- Python, Ruby, PHP, Node.JS, C/C++ experimental support.
- Command Line/Jenkins/Gradle/Maven/Ant plugins and tooling all exist in various forms of maturity.

# DEPENDENCY CHECK IN ACTION

Java (Maven)

```
mvn dependency-check:check
```

```
<plugin>
  <groupId>org.owasp</groupId>
  <artifactId>dependency-check-maven</artifactId>
  <version>3.3.2</version>
  <configuration>
    <cveValidForHours>24</cveValidForHours>
    <failBuildOnCVSS>4</failBuildOnCVSS>
    <format>XML</format>
    <suppressionFile>suppression.xml</suppressionFile>
  </configuration>
  <executions>
    <execution>
      <goals>
        <goal>aggregate</goal>
      </goals>
      <phase>package</phase>
    </execution>
  </executions>
</plugin>
```

```
[INFO] Central analyzer disabled
[INFO] Checking for updates
[INFO] Skipping NVD check since last check was within 24 hours.
[INFO] Skipping RetireJS update since last update was within 24 hours.
[INFO] Check for updates complete (24 ms)
[INFO] Analysis Started
[INFO] Finished Archive Analyzer (1 seconds)
[INFO] Finished File Name Analyzer (0 seconds)
[INFO] Finished Jar Analyzer (0 seconds)
[INFO] Finished Dependency Merging Analyzer (0 seconds)
[INFO] Finished Version Filter Analyzer (0 seconds)
[INFO] Finished Hint Analyzer (0 seconds)
[INFO] Created CPE Index (1 seconds)
[INFO] Skipping CPE Analysis for npm
[INFO] Finished CPE Analyzer (1 seconds)
[INFO] Finished False Positive Analyzer (0 seconds)
[INFO] Finished NVD CVE Analyzer (0 seconds)
[INFO] Finished Vulnerability Suppression Analyzer (0 seconds)
[INFO] Finished Dependency Bundling Analyzer (0 seconds)
[INFO] Analysis Complete (3 seconds)
```

# DEPENDENCY CHECK IN ACTION

## Command Line

```
D:\_Code\BikeShop\dependency-check\bin>dependency-check -s ..\**\*.dll --project BikeShop
```

## MSBuild Task

```
<Target Name="OWASP Check" AfterTargets="Build">  
  <Message Text="Running OWASP Depedency Check" Importance="high" />  
  <Exec Command="dependency-check -s ..\**\*.dll --project BikeShop --failOnCVSS 1" WorkingDirectory="..\dependency-check\bin" />  
</Target>
```

<https://jeremylong.github.io/DependencyCheck/dependency-check-cli/arguments.html>

# DEPENDENCY CHECK IN ACTION

## Jenkins Integration

### DependencyCheck Result

#### Warnings Trend

All Warnings	New Warnings	Fixed Warnings
153	138	0

#### Summary

Total	High Priority	Normal Priority	Low Priority
153	24	111	18

#### Details

Files	Categories	Types	Warnings	Details	New	High	Normal	Low
Category		Total	Distribution					
CWE-119 Improper Restriction of Operations within the Bounds of a Memory Buffer		5	<div><div></div><div></div><div></div><div></div><div></div></div>					
CWE-134 Uncontrolled Format String		1	<div><div></div><div></div><div></div><div></div><div></div></div>					
CWE-189 Numeric Errors		2	<div><div></div><div></div><div></div><div></div><div></div></div>					
CWE-20 Improper Input Validation		7	<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div>					
CWE-200 Information Exposure		5	<div><div></div><div></div><div></div><div></div><div></div></div>					
CWE-22 Improper Limitation of a Pathname to a Restricted Directory ('Path Traversal')		4	<div><div></div><div></div><div></div><div></div><div></div></div>					
CWE-264 Permissions, Privileges, and Access Controls		4	<div><div></div><div></div><div></div><div></div><div></div></div>					
CWE-287 Improper Authentication		2	<div><div></div><div></div><div></div><div></div><div></div></div>					
CWE-310 Cryptographic Issues		2	<div><div></div><div></div><div></div><div></div><div></div></div>					
CWE-399 Resource Management Errors		7	<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div>					
CWE-59 Improper Link Resolution Before File Access ('Link Following')		4	<div><div></div><div></div><div></div><div></div><div></div></div>					
CWE-79 Improper Neutralization of Input During Web Page Generation ('Cross-site Scripting')		14	<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div>					
CWE-89 Improper Neutralization of Special Elements used in an SQL Command ('SQL Injection')		2	<div><div></div><div></div><div></div><div></div><div></div></div>					
CWE-94 Improper Control of Generation of Code ('Code Injection')		10	<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div>					
Total		153						



0 vulnerabilities.

- No warnings since build 619.
- New zero warnings highscore: no warnings for 4 days!

```
configure { project ->
  project / 'builders' / 'org.jenkinsci.plugins.DependencyCheck.DependencyCheckBuilder'(plugin: 'dependency-check-jenkins-plugin@3.1.2.1') {
    skipOnScmChange false
    skipOnUpstreamChange false
    scanpath ''
    outdir ''
    datadir ''
    suppressionFile ''
    hintsFile ''
    zipExtensions ''
    isAutoupdateDisabled false
    includeHtmlReports false
    includeVulnReports false
    includeJsonReports false
    includeCsvReports false
  }
}

publishers {
  dependencyCheck('***dependency-check-report.xml') {
    healthLimits(3, 20)
    thresholdLimit('high')
    defaultEncoding('UTF-8')
    canRunOnFailed(true)
    useStableBuildAsReference(true)
    useDeltaValues(true)
    computeNew(true)
    shouldDetectModules(true)
    thresholds(
      unstableTotal: [all: 1, high: 2, normal: 3, low: 4],
      failedTotal: [all: 5, high: 6, normal: 7, low: 8],
      unstableNew: [all: 9, high: 10, normal: 11, low: 12],
      failedNew: [all: 13, high: 14, normal: 15, low: 16]
    )
  }
}
```

# HOW BAD CAN IT BE?

```
C:\WINDOWS\system32\cmd.exe
[ERROR] Failed to execute goal org.owasp:dependency-check-maven:3.1.2:check (default-cli) on project commons-aem-b
in. :
[ERROR] One or more dependencies were identified with vulnerabilities that have a CVSS score greater than or equal to '4
.0':
[ERROR]
[ERROR] oak-blob-1.6.1.jar: CVE-2015-1833
[ERROR] oak-core-1.6.1.jar: CVE-2007-1349, CVE-2015-1833
[ERROR] org.apache.sling.models.api-1.3.6.jar: CVE-2013-4390, CVE-2016-0956, CVE-2015-2944
[ERROR] jackson-databind-2.8.4.jar: CVE-2017-15095, CVE-2017-17485, CVE-2017-7525, CVE-2018-7489, CVE-2018-5968
[ERROR] poi-3.6.jar: CVE-2014-9527, CVE-2016-5000, CVE-2017-5644, CVE-2014-3574, CVE-2012-0213, CVE-2014-3529, CVE-2017-
12626
[ERROR] httpclient-4.0-alpha4.jar: CVE-2015-5262, CVE-2011-1498, CVE-2014-3577
[ERROR] commons-collections-3.2.1.jar: CVE-2015-6420, CVE-2017-15708
[ERROR]
[ERROR] See the dependency-check report for more details.
[ERROR]
```

# SPECIAL BONUS TOOL: NPM AUDIT!

```
Dependency of sonarqube-scanner [dev]
Path sonarqube-scanner > download > caw > tunnel-agent
More info https://nodesecurity.io/advisories/598

Moderate Regular Expression Denial of Service
Package slug
Dependency of sonarqube-scanner [dev]
Path sonarqube-scanner > slug
More info https://nodesecurity.io/advisories/537

Run npm update jquery --depth 2 to resolve 1 vulnerability
High Cross-Site Scripting (XSS)
Package jquery
Dependency of slick-carousel
Path slick-carousel > jquery
More info https://nodesecurity.io/advisories/328
```



# OWASP SONARQUBE RULES



# OWASP SONARQUBE RULES

## Benefits

A number of “suggested” rulesets to add to your static code analysis to catch common security issues before they can ever be merged in.

## How it works

Integrates into Sonarqube natively as a ruleset. Performs static code analysis to see if the code violates any of the rules and flags as necessary. If running SonarQube as part of your build pipeline (and if you aren't...) it'll raise violations as critical allowing you to fail builds or fail merge checks.

## Implementations

- Java/Groovy
- Sonarqube itself ships with a number of rulesets for Javascript/Typescript/Ruby/Python/PHP/Swift/C#/etc

# SONARQUBE RULES IN ACTION

Quality Gates, in line reporting, corrective action

## Conditions

Only project measures are checked against thresholds. Sub-projects, directories and files are ignored. [More](#)

Metric	Over Leak Period	Operator	Warning	Error
Bugs	No	is greater than	0	5
Security Rating	Never	is worse than	A	B
Vulnerabilities	No	is greater than	0	0

## Projects

Every project not specifically associated to a quality gate will be associated to this one by default.

```
public Document callAPI(String url) throws IOException {
    Document doc = null;
    HttpClient httpClient = new DefaultHttpClient();
    ...
    HttpGet get = new HttpGet(url);
    ...
}
```

DefaultHttpClient with default constructor is not compatible with TLS 1.2

3 months ago L202

Vulnerability Major Open Not assigned

cryptography, owasp-a6

Concatenating user-controlled input into a URL

3 months ago L203

Vulnerability Major Open Not assigned

No tags

SonarQube analysis reported 15 issues

- 1 critical
- 14 minor

Watch the comments in this conversation to review them.



# ZAP ATTACK PROXY

# ZAP ATTACK PROXY

## Benefits

Automatically hits your site/server probing for vulnerabilities.

## How it works

Scans your machine with a configurable set of rules looking for common vulnerabilities and outputs a report. Looks for all the common OWASP top 10 violations as well as misconfigured machines, etc.

## Implementations

Has a large, customizable rule set as well as integration points with Jenkins and prebuilt docker images as well as an official Jenkins plugin.

# ZAP OPTIONS

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GUI – Java based, uses SWING

CLI – Command line interface

REST - API

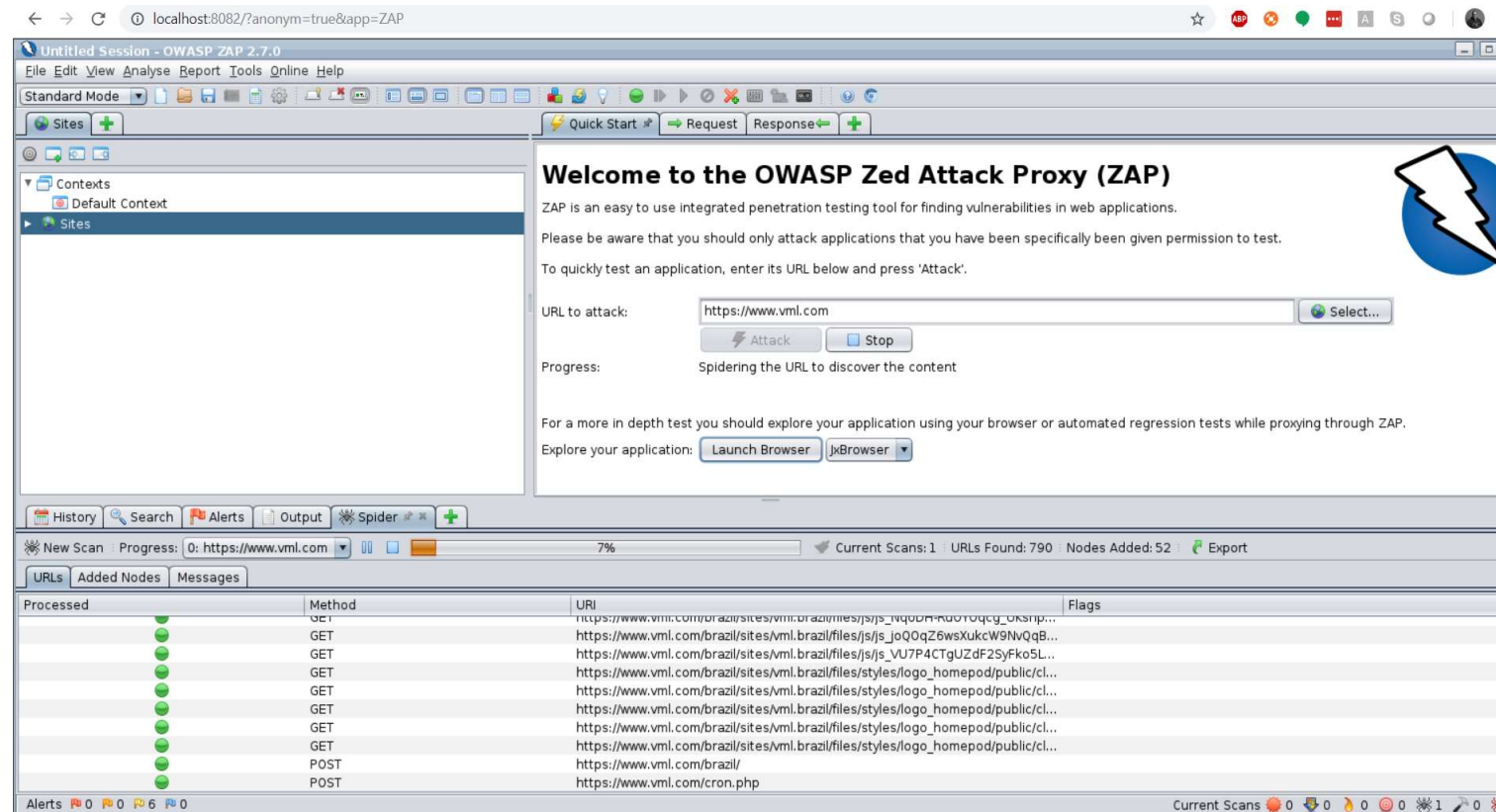
Jenkins Plugin

# ZAP IN ACTION

## GUI

There is a GUI available to run a “traditional” scan but this Isn’t very scriptable.

Great for exploratory testing and figuring out your options.

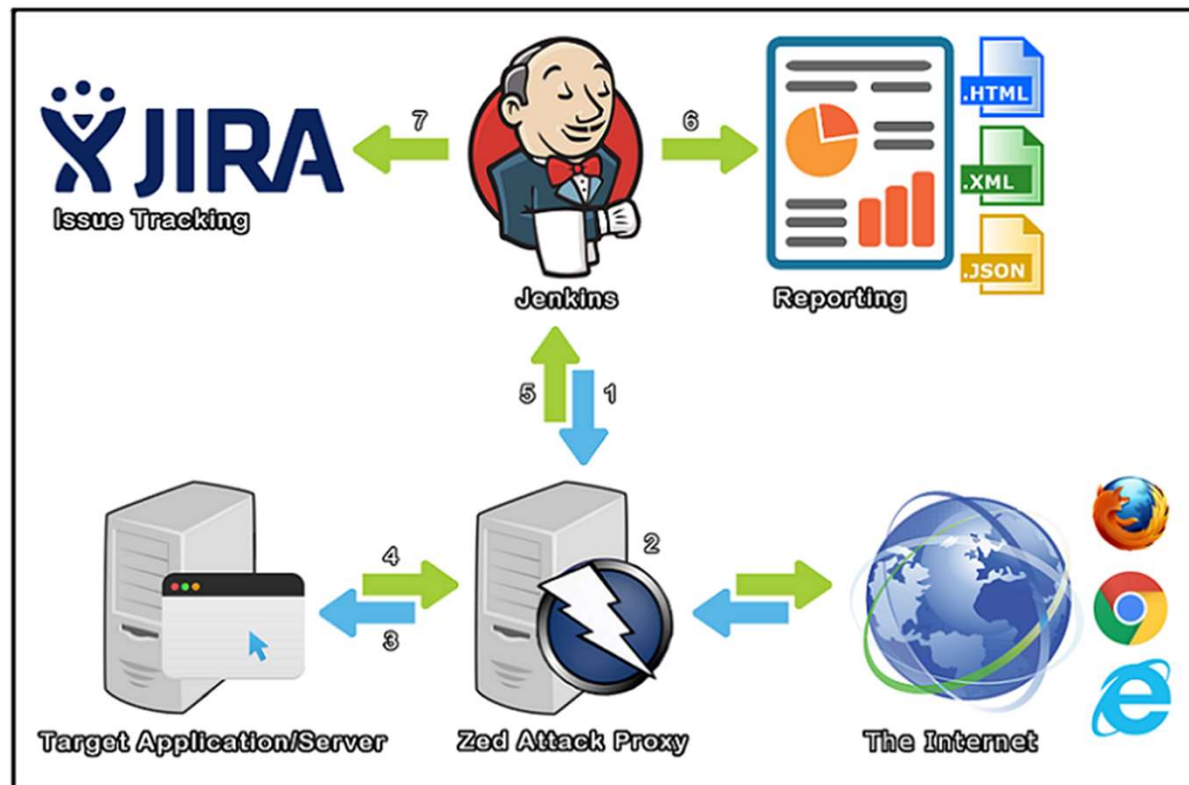


# ZAP IN ACTION: JENKINS PLUGIN

Also an official Jenkins plugin.

Has Integration with JIRA.

Requires full install of OWASP ZAP.

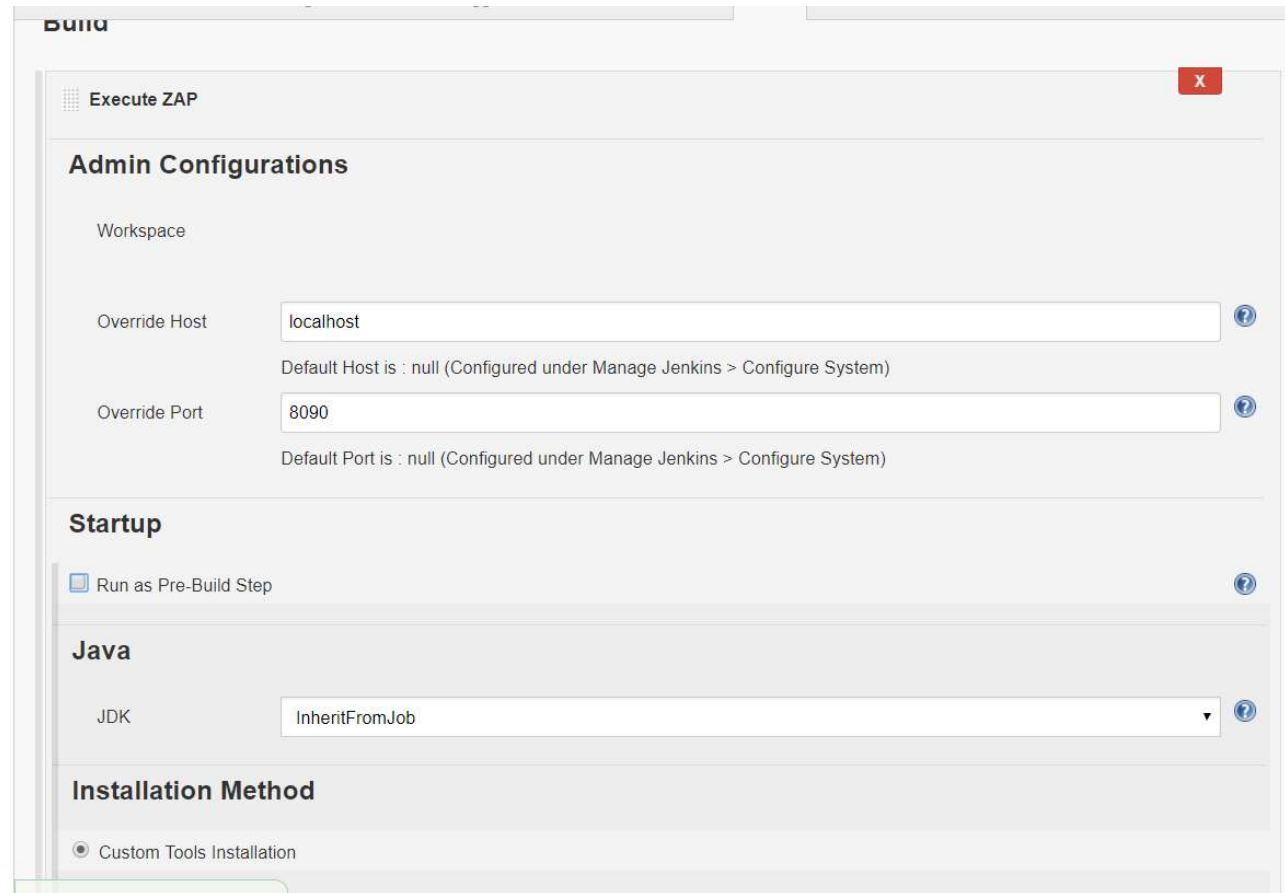




# ZAP IN ACTION: JENKINS PLUGIN

## Drawbacks

Great integration, but requires owasp zap server to be running on same container as Jenkins OR have Jenkins slave installed on your owasp container.



The screenshot shows the 'Execute ZAP' configuration page in Jenkins. The page is titled 'Build' at the top left and 'Execute ZAP' at the top right. It is divided into several sections: 'Admin Configurations', 'Startup', 'Java', and 'Installation Method'. In the 'Admin Configurations' section, there are fields for 'Workspace', 'Override Host' (set to 'localhost'), and 'Override Port' (set to '8090'). Below these fields, it states 'Default Host is : null (Configured under Manage Jenkins > Configure System)' and 'Default Port is : null (Configured under Manage Jenkins > Configure System)'. In the 'Startup' section, there is a checkbox for 'Run as Pre-Build Step'. In the 'Java' section, there is a dropdown menu for 'JDK' set to 'InheritFromJob'. In the 'Installation Method' section, there is a radio button for 'Custom Tools Installation'.

**Build**

**Execute ZAP**

**Admin Configurations**

Workspace

Override Host: localhost

Default Host is : null (Configured under Manage Jenkins > Configure System)

Override Port: 8090

Default Port is : null (Configured under Manage Jenkins > Configure System)

**Startup**

☐ Run as Pre-Build Step

**Java**

JDK: InheritFromJob

**Installation Method**

☒ Custom Tools Installation

# ZAP IN ACTION: ZAP CLI

## Quick Scan

Runs a very basic scan, limited to one minute

## Baseline

Completely safe, usually very quick.

## Active Scan

Not safe, potentially legal / production impacting.

```
C:\Users\bdinger>docker run -i owasp/zap2docker-stable zap-cli quick-scan --self-contained --start-options "-config api.disablekey=true" http://owasp.localdev.com
[INFO] Starting ZAP daemon
[INFO] Running a quick scan for http://owasp.localdev.com
[INFO] Issues found: 0
[INFO] Shutting down ZAP daemon
```

# ZAP IN ACTION: ZAP-API

## Invoke VIA API

ZAP api provides a rich feature set.

Best use case is in docker container setups.

Suggestion is to chain to your Jenkins instance and invoke

# ZED ATTACK PROXY: TIPS

## Run as the last stage of your pipeline

ZAP requires that the code actually be running before it can be tested like automated QA tests.

## Or as a schedule task

In case the complexity of a build being deployed, then being failed back, is too risky for your environment you can instead run it on a set schedule and use the results of that to inform deployment decisions.

## Lots of Resources

Zap consumes major resources running and will easily bring a machine to its knees. Provision it well and (suggested) to use a docker container and scale/destroy as needed. Don't run it on same box as your Jenkins machine!

# ZAP SCAN INFRASTRUCTURE OPTIONS

## Run in a separate container

Build as a separate docker container invoked in parallel with you build.

## Run in same container

Assuming you build containers and deploy them to your infrastructure, can build the containers with the OWASP tool and run against container.

## Run in jenkins

As mentioned, can run in the same box as Jenkins but will require a lot of resources.



# OPEN WEB TESTING FRAMEWORK

# OPEN WEB TESTING FRAMEWORK

## Benefits

An active pen testers framework.

## How it works

Provides a prebuilt environment with a number of configurable plugins. Designed to help your active penetration testers run their security tests against your site. Note this differs from ZAP (Zed Attack Proxy) which is *solely* an automated attack proxy.

## Implementations

Currently implemented and distributed as alive cd/ docker image / homebrew package





# WEB TESTING ENVIRONMENTS

# WEB TESTING ENVIRONMENT

## Benefits

A prebuilt image (or series of packages) with common AppSec tools built into them.

## How it works

OWASP supplies a few images and packages with a number of popular security testing tools – like nmap – already built in. This allows you to grab a stock, standard prebuilt image that can be spun up and either further automated or simply handed off to your security testing team.

## Implementations

Besides Debian packages also includes Vmware, Virtuablebox and parallels images as well as a docker image (soon)

# WTE: IN ACTION

## **Automated with run commands**

Stable docker image that can run nmap, etc script commands via docker or Jenkins.

## **Spun up to evaluate environments**

Start up and provision as part of pipeline to be handed off to penetration testing team

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# APPLICATION SECURITY VERIFICATION STANDARDS

# ASVS

## Benefits

A guidebook to securing your application stack.

## How it works

A series of checklists and procedures covering the whole gamut of security to ensure you're critical infrastructure (like your devops pipelines) is fully secure.

## Implementations

Documentation available on OWASPs site

# ASVS EXAMPLE AUDIT

#	Description	1	2	3	Since
2.1	Verify all pages and resources by default require authentication except those specifically intended to be public (Principle of complete mediation).	✓	✓	✓	1.0
2.2	Verify that all password fields do not echo the user's password when it is entered.	✓	✓	✓	1.0
2.4	Verify all authentication controls are enforced on the server side.	✓	✓	✓	1.0
2.6	Verify all authentication controls fail securely to ensure attackers cannot log in.	✓	✓	✓	1.0
2.7	Verify password entry fields allow, or encourage, the use of passphrases, and do not prevent long passphrases/highly complex passwords being entered.	✓	✓	✓	3.0
2.8	Verify all account identity authentication functions (such as update profile, forgot password, disabled / lost token, help desk or IVR) that might regain access to the account are at least as resistant to attack as the primary authentication mechanism.	✓	✓	✓	2.0
2.9	Verify that the changing password functionality includes the old password, the new password, and a password confirmation.	✓	✓	✓	1.0
2.12	Verify that all suspicious authentication decisions are logged. This should include requests with relevant metadata needed for security investigations.		✓	✓	2.0
2.13	Verify that account passwords make use of a sufficient strength encryption routine and that it withstands brute force attack against the encryption routine.		✓	✓	3.0
2.16	Verify that credentials are transported using a suitable encrypted link and that all pages/functions that require a user to enter credentials are done so using an encrypted link.	✓	✓	✓	3.0

REMEMBER: IF YOUR CI/CD STACK IS COMPROMISED  
YOU'VE LOST EFFECTIVE CONTROL OF ALL APPS



GO FORTH AND BUILD RUGGED SOFTWARE

# RESOURCES

OWASP Top 10 Project:

[https://www.owasp.org/index.php/Category:OWASP\\_Top\\_Ten\\_Project](https://www.owasp.org/index.php/Category:OWASP_Top_Ten_Project)

OWASP Cheat Sheet Series:

[https://www.owasp.org/index.php/OWASP\\_Cheat\\_Sheet\\_Series](https://www.owasp.org/index.php/OWASP_Cheat_Sheet_Series)

OWASP Docker Hub:

<https://hub.docker.com/u/owasp/>

Continuous Deployment with Docker & Jenkins:

<http://vfarcic.github.io/jenkins-swarm/index.html>

OWASP Dependency Check:

<https://jeremylong.github.io/DependencyCheck/index.html>

Docker & OWASP Setup:

<https://blog.mozilla.org/fxtesteng/2016/05/11/docker-owasp-zap-part-one/>

OWASP Zap automated scan list based on Swagger definitions

<https://www.nearform.com/blog/zed-attack-proxy-in-a-ci-pipeline/>

THANK YOU.

