Automated Security Testing In Continuous Integration

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Agenda

whoami?

why?

what?

how?

whoami?

Christian Kühn

system developer
#java #kubernetes #devops
@DevOpsKA Meetup Organizer

synyx GmbH Karlsruhe

code with attitude!

sw development
consulting

synyx

questions ~~?~~!

software security issues: what could possibly go wrong?

- leakage of business data
- leakage of user/customer data
- service interruption
- industry malfunction
- death (😱)

examples:

equifax - “Credit Monitoring”

hacked 2017
vulnerability in Apache Struts dependency

143,000,000 SSN
209,000 credit card numbers
182,000 “consumers” with PII

https://krebsonsecurity.com/2017/09/the-equifax-breach-what-you-should-know/

examples:

Mossack Fonseca - “Law Firm and coprorate service provider”

hacked 2015
vulnerability in Drupal

11.5 million leaked documents about
money laundering
tax avoidance
corruption

https://en.wikipedia.org/wiki/Panama_Papers

what stops developers from patching?

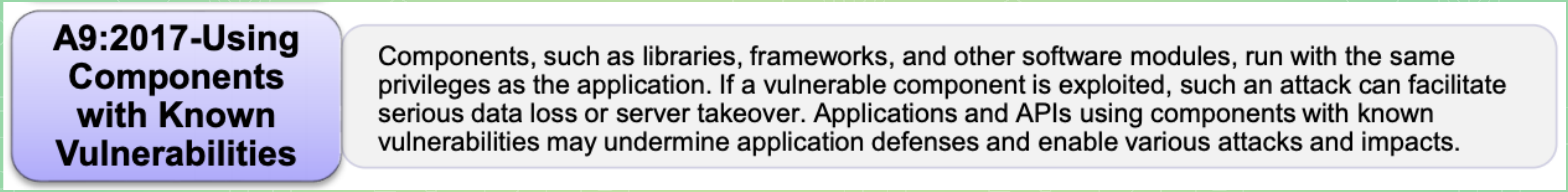
negligence

priorities / lack of time

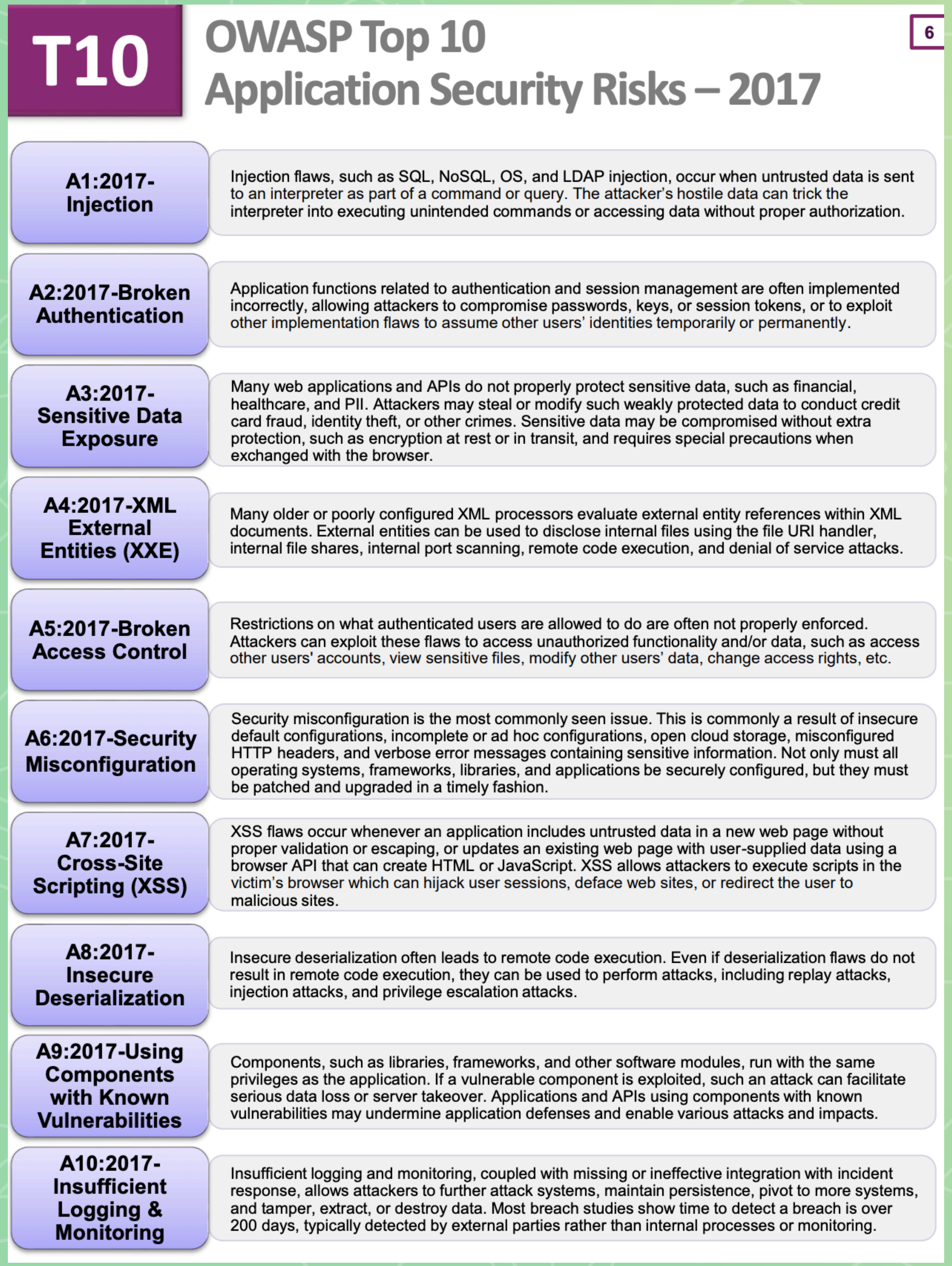
skills / training

insight

“security - not my department” (or is it?)



A9:2017-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. Applications and APIs using components with known vulnerabilities may undermine application defenses and enable various attacks and impacts.



T10 OWASP Top 10 Application Security Risks – 2017

6

A1:2017-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.
A2:2017-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.
A3:2017-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.
A4:2017-XML External Entities (XXE)	Many older or poorly configured XML processors evaluate external entity references within XML documents. External entities can be used to disclose internal files using the file URI handler, internal file shares, internal port scanning, remote code execution, and denial of service attacks.
A5:2017-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.
A6:2017-Security Misconfiguration	Security misconfiguration is the most commonly seen issue. This is 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. Not only must all operating systems, frameworks, libraries, and applications be securely configured, but they must be patched and upgraded in a timely fashion.
A7:2017-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.
A8:2017-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.
A9:2017-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. Applications and APIs using components with known vulnerabilities may undermine application defenses and enable various attacks and impacts.
A10:2017-Insufficient Logging & Monitoring	Insufficient logging and monitoring, coupled with missing or ineffective integration with incident response, allows attackers to further attack systems, maintain persistence, pivot to more systems, and tamper, extract, or destroy data. Most breach studies show time to detect a breach is over 200 days, typically detected by external parties rather than internal processes or monitoring.

OWASP
Open Web Application Security Project

vulnerability

/vʌln(ə)rəˈbɪlɪti/

noun

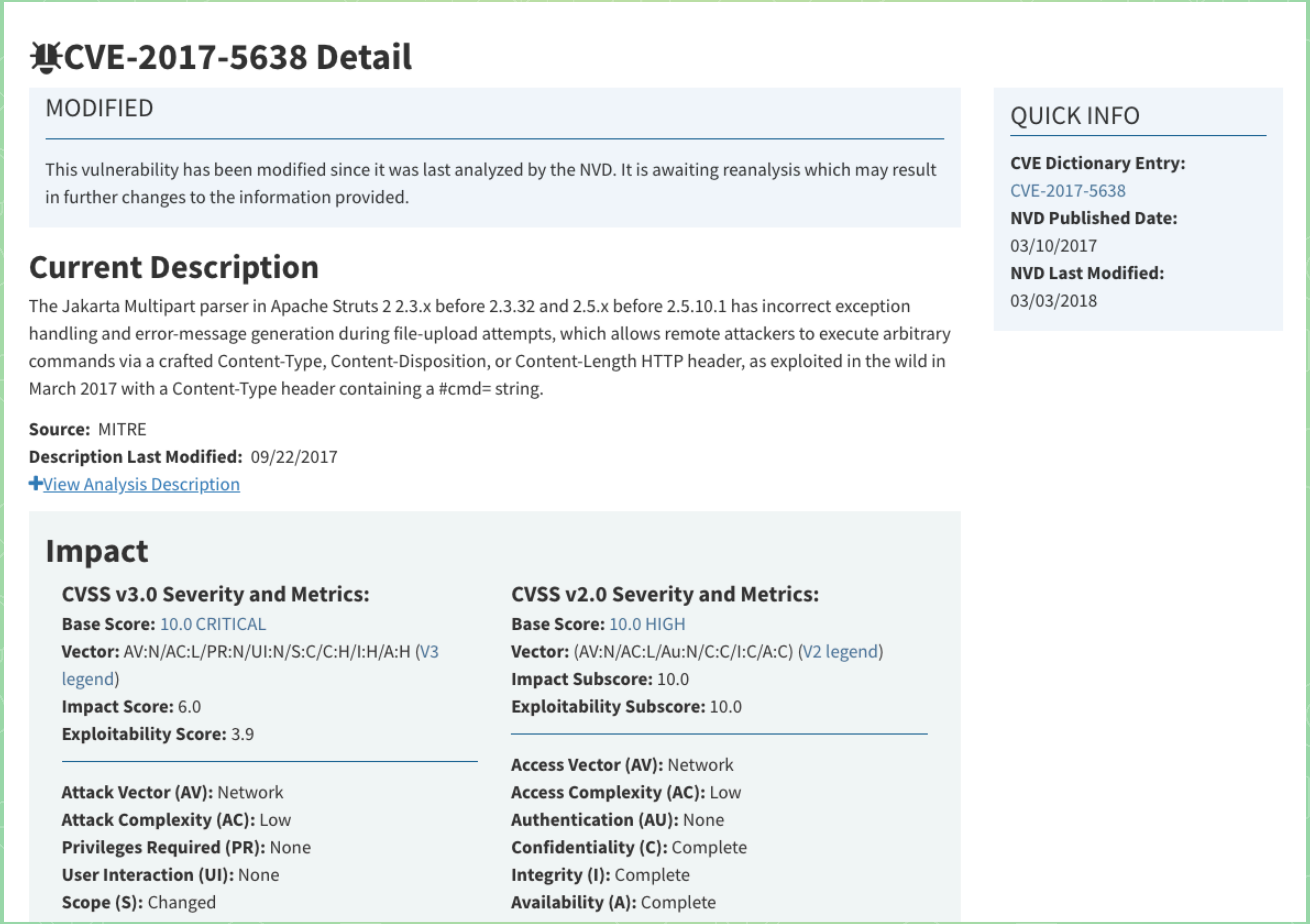
1. the quality or state of being exposed to the possibility of being attacked or harmed, either physically or emotionally.

   ...

CVE

"reference for publicly known information-security vulnerabilities and exposures"

public CVE Database - sponsored by NIST
(National Institute of Standards and Technology)



CVE-2017-5638 Detail

MODIFIED

This vulnerability has been modified since it was last analyzed by the NVD. It is awaiting reanalysis which may result in further changes to the information provided.

Current Description

The Jakarta Multipart parser in Apache Struts 2 2.3.x before 2.3.32 and 2.5.x before 2.5.10.1 has incorrect exception handling and error-message generation during file-upload attempts, which allows remote attackers to execute arbitrary commands via a crafted Content-Type, Content-Disposition, or Content-Length HTTP header, as exploited in the wild in March 2017 with a Content-Type header containing a #cmd= string.

Source: MITRE
Description Last Modified: 09/22/2017
View Analysis Description

QUICK INFO

CVE Dictionary Entry:
CVE-2017-5638
NVD Published Date:
03/10/2017
NVD Last Modified:
03/03/2018

Impact

CVSS v3.0 Severity and Metrics:
Base Score: 10.0 CRITICAL
Vector: AV:N/AC:L/PR:N/UI:N/S:C/C:H/I:H/A:H (V3 legend)
Impact Score: 6.0
Exploitability Score: 3.9

Attack Vector (AV): Network
Attack Complexity (AC): Low
Privileges Required (PR): None
User Interaction (UI): None
Scope (S): Changed

CVSS v2.0 Severity and Metrics:
Base Score: 10.0 HIGH
Vector: (AV:N/AC:L/Au:N/C:C/I:C/A:C) (V2 legend)
Impact Subscore: 10.0
Exploitability Subscore: 10.0

Access Vector (AV): Network
Access Complexity (AC): Low
Authentication (AU): None
Confidentiality (C): Complete
Integrity (I): Complete
Availability (A): Complete

solution

search for known vulnerabilities

implement a process to fix ASAP (or whitelist 😇)

treat security issues like technical debt

automate the sh!t out of it

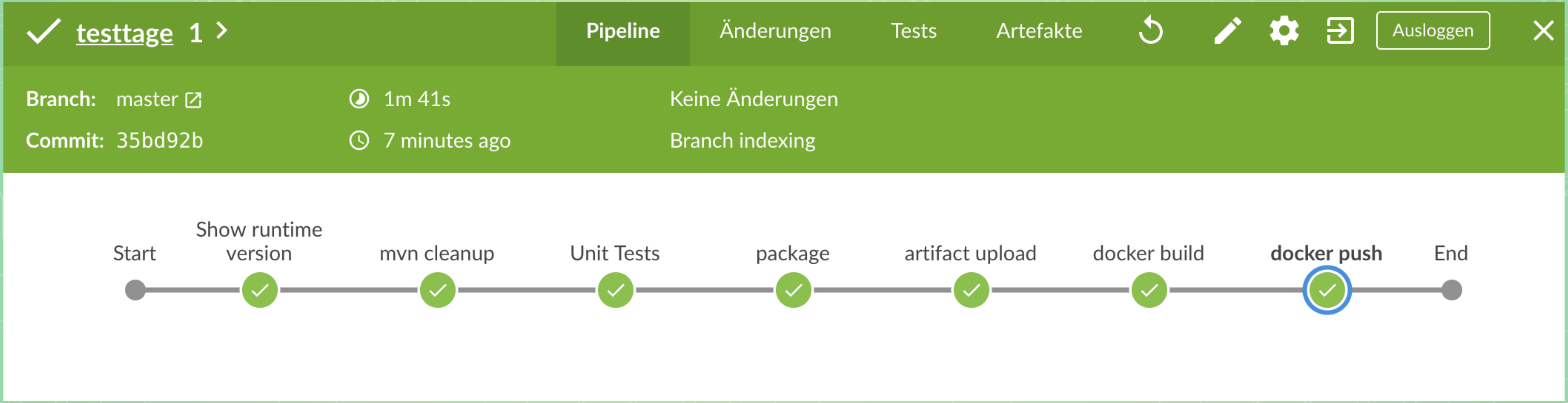
let's automatically find KNOWN vulnerabilities in

dependencies / 3rd party libs

components in docker images

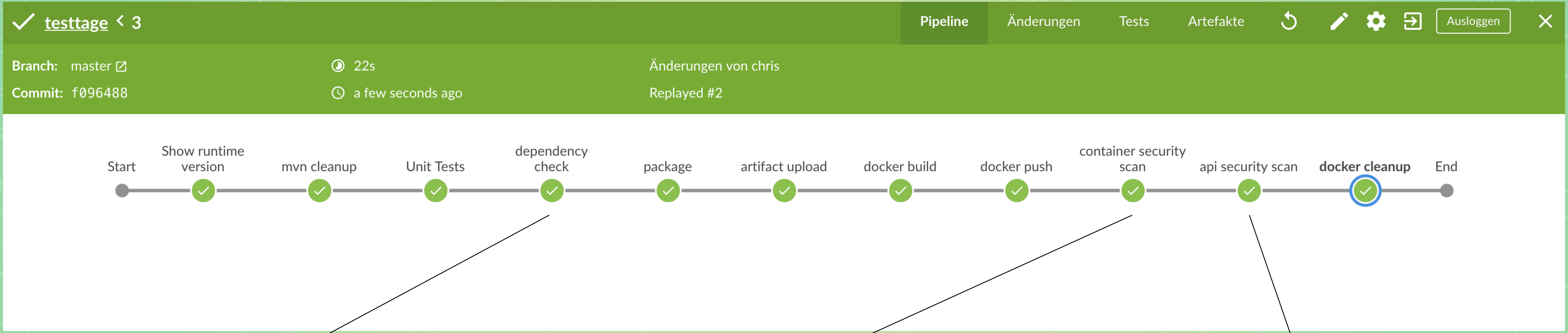
(let's also scan our app dynamically)

continuous delivery today

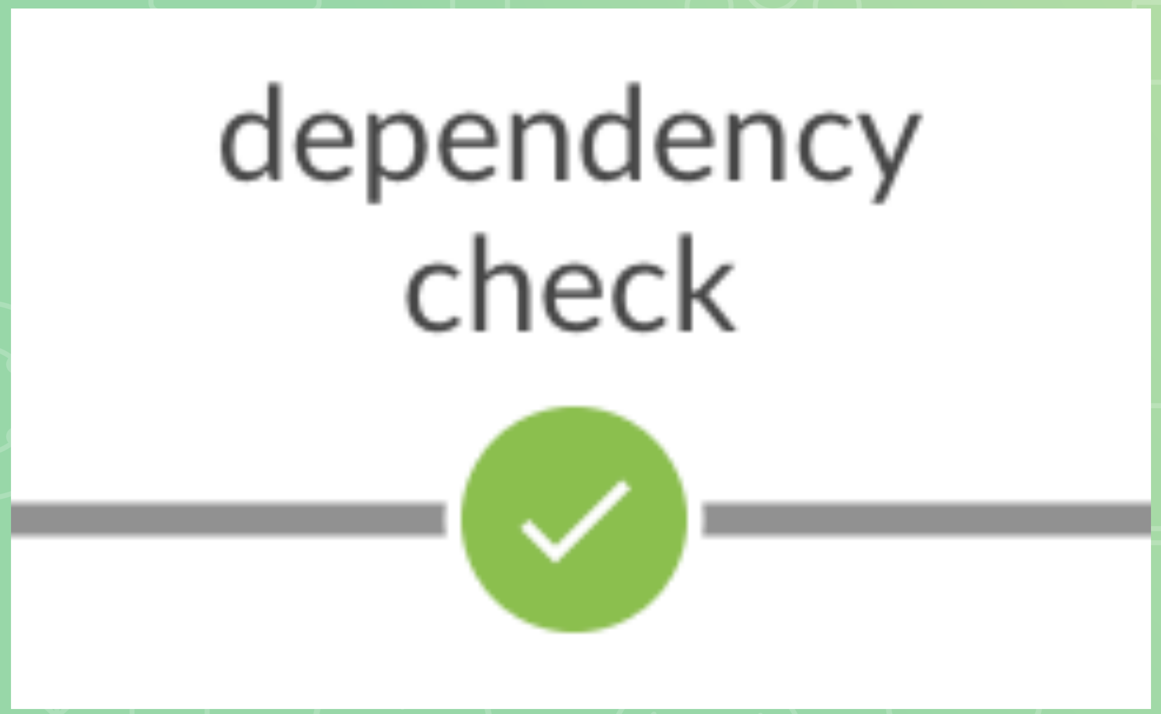


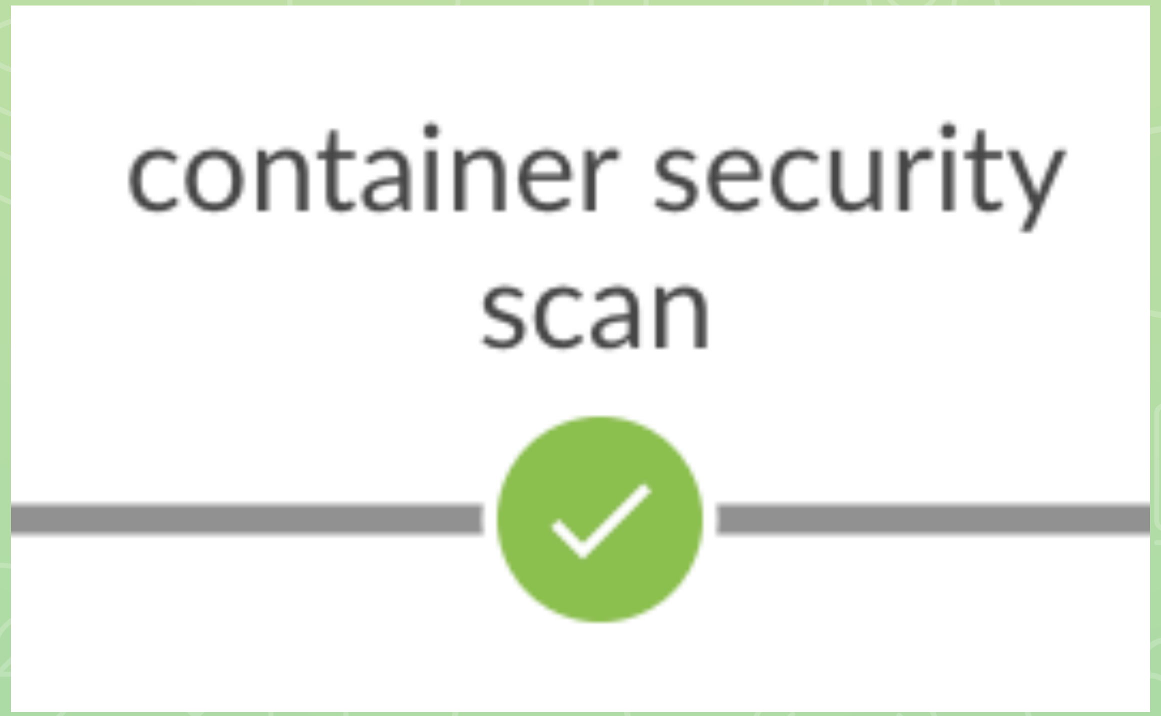
Branch: master
Commit: 35bd92b
1m 41s
7 minutes ago
Keine Änderungen
Branch indexing

continuous delivery ++

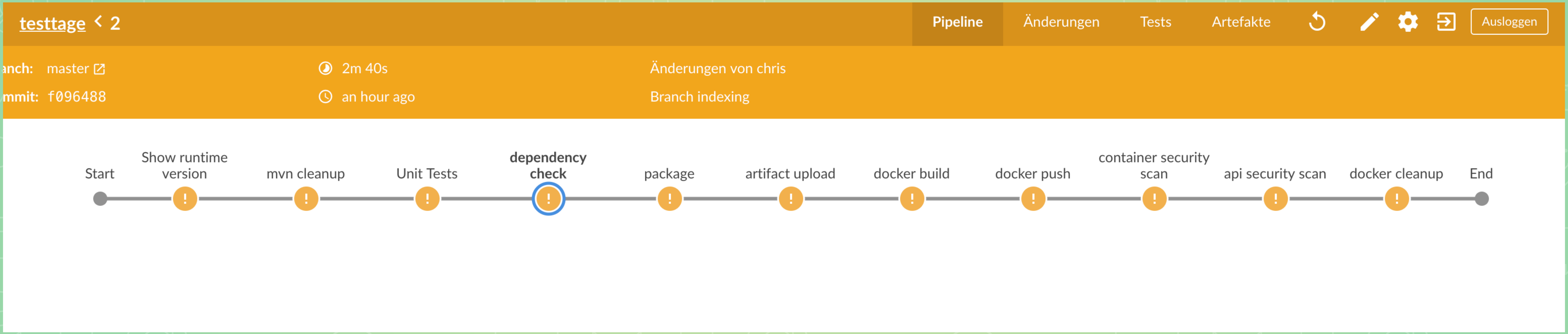


Branch: master
Commit: f096488
22s
a few seconds ago
Änderungen von chris
Replayed #2





continuous delivery++



testtage < 2

Pipeline · Änderungen · Tests · Artefakte · Ausloggen

anch: master
mmit: f096488

2m 40s
an hour ago

Änderungen von chris
Branch indexing

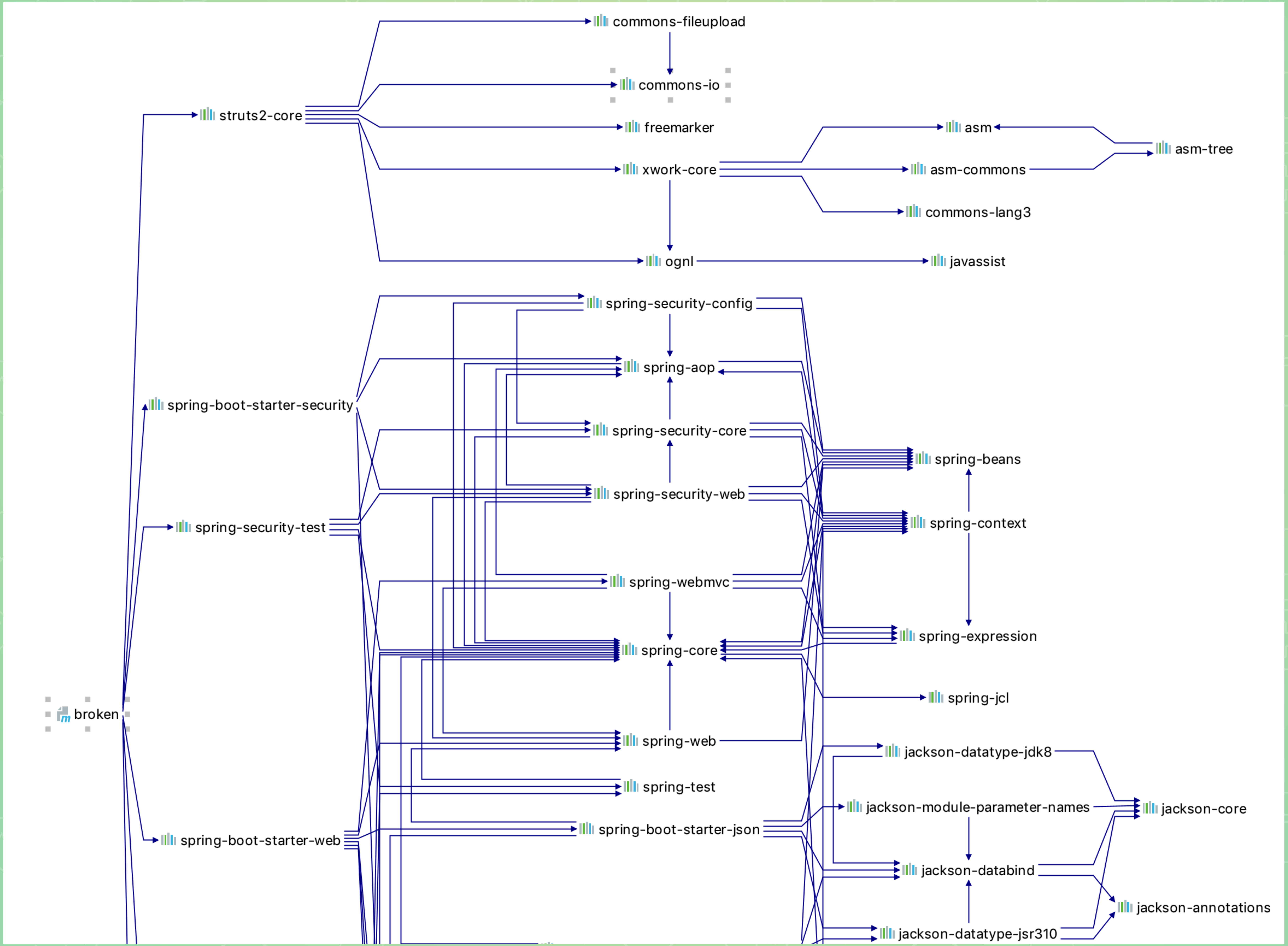
dependencies | components | 3rdparty libraries

example: little maven/springboot demo-project:

6 maven dependencies

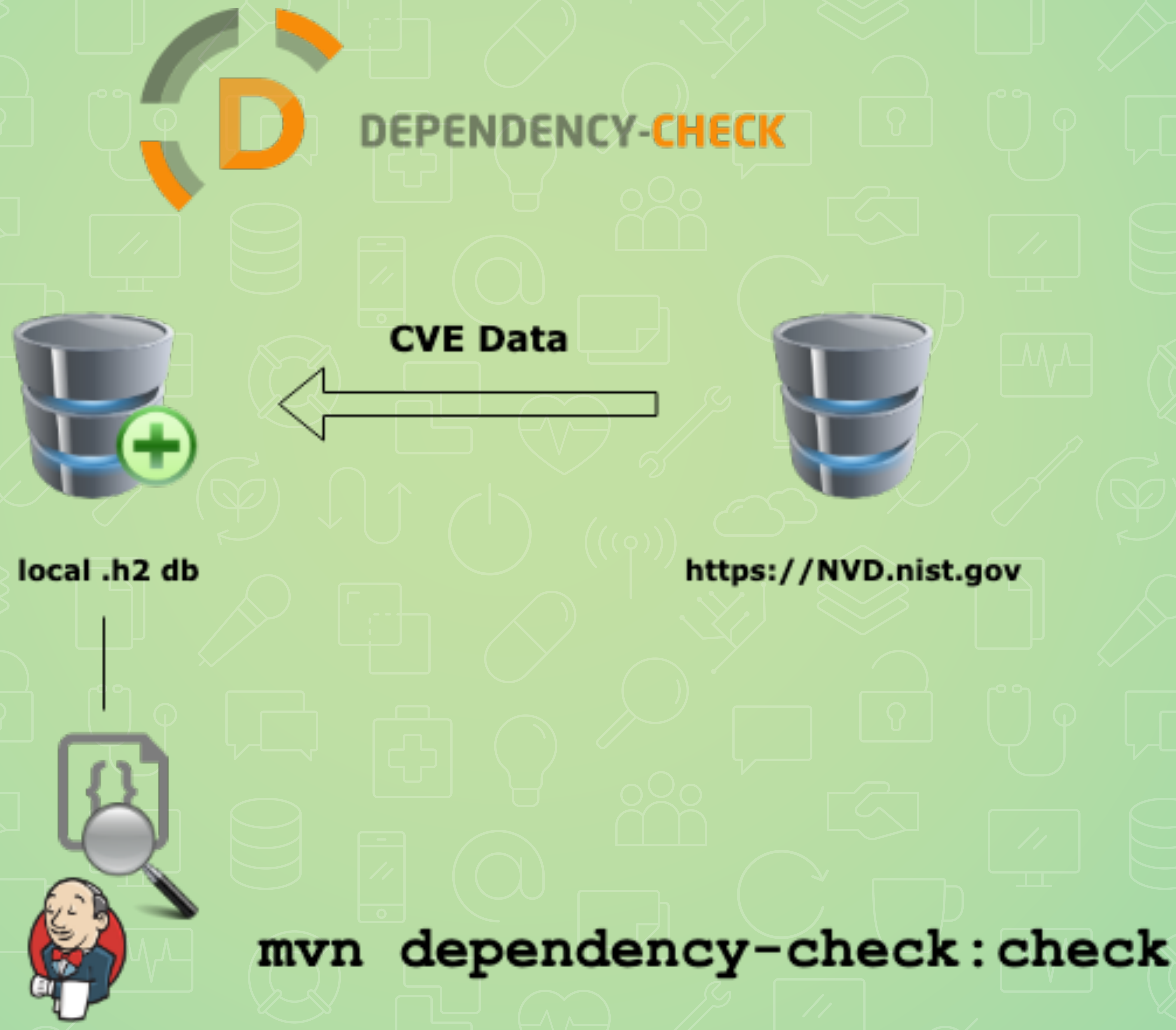
71 transitive dependencies

github.com/cy4n/broken

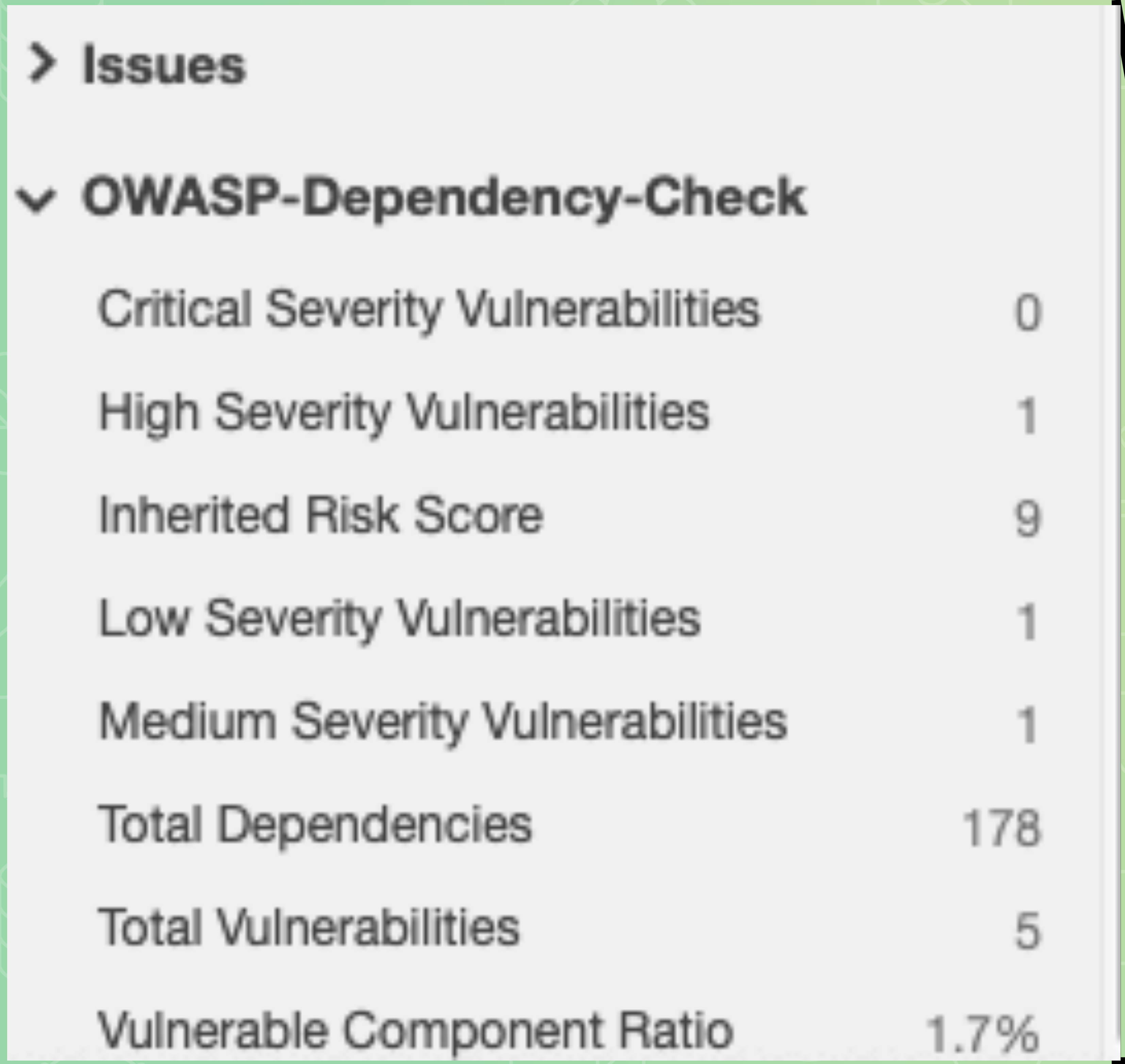

commons-fileupload
commons-io
struts2-core
freemarker
asm
asm-tree
xwork-core
asm-commons
commons-lang3
ognl
javassist
spring-security-config
spring-aop
spring-boot-starter-security
spring-security-core
spring-beans
spring-security-web
spring-context
spring-security-test
spring-webmvc
spring-expression
spring-core
spring-jcl
broken
spring-web
jackson-datatype-jdk8
spring-test
jackson-module-parameter-names
jackson-core
spring-boot-starter-json
spring-boot-starter-web
jackson-databind
jackson-annotations
jackson-datatype-jsr310

find vulnerable dependencies

DEPENDENCY-CHECK


DEPENDENCY-CHECK
CVE Data
local .h2 db
https://NVD.nist.gov
mvn dependency-check:check

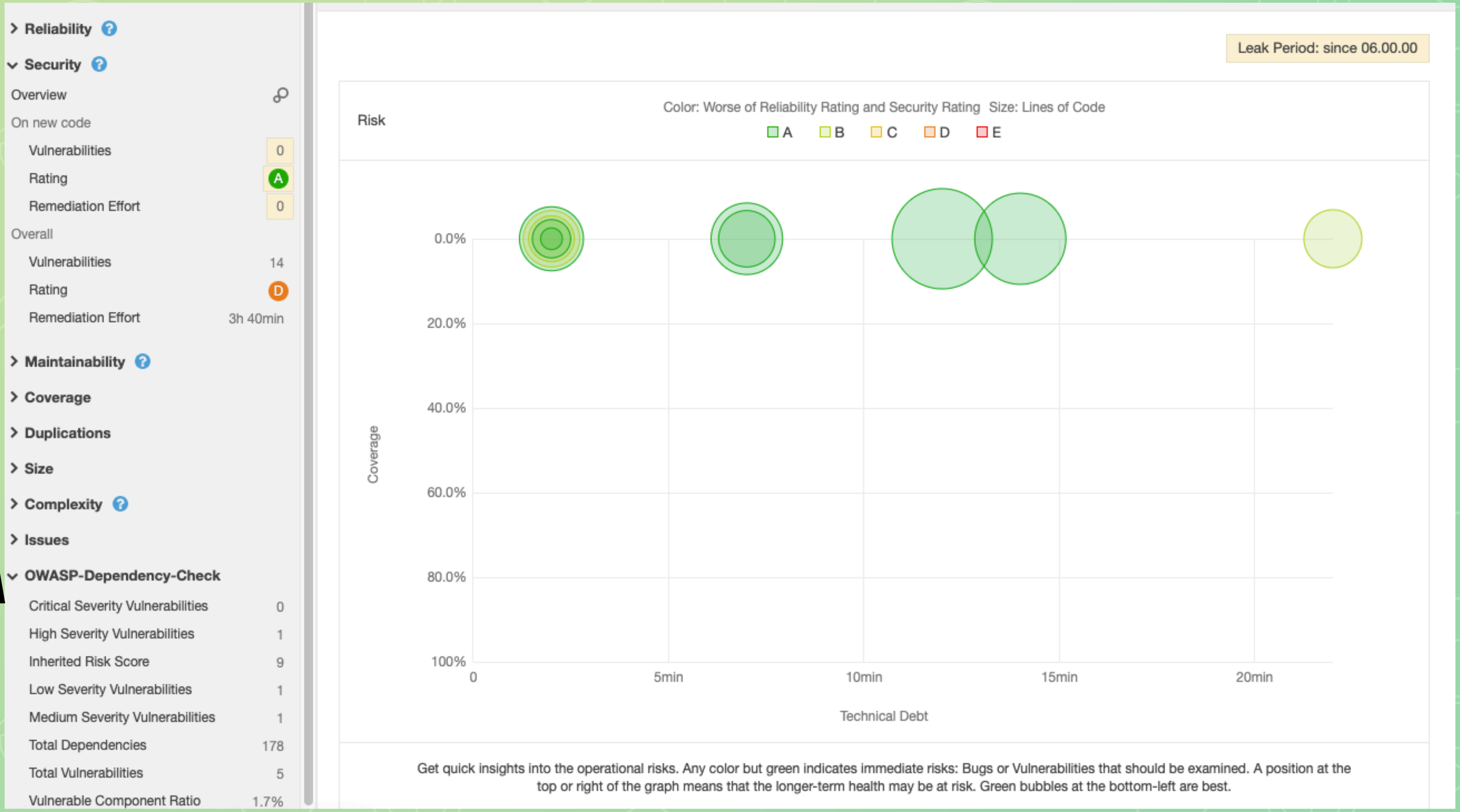
DEPENDENCY-CHECK



› Issues

⌄ OWASP-Dependency-Check

Critical Severity Vulnerabilities	0
High Severity Vulnerabilities	1
Inherited Risk Score	9
Low Severity Vulnerabilities	1
Medium Severity Vulnerabilities	1
Total Dependencies	178
Total Vulnerabilities	5
Vulnerable Component Ratio	1.7%



› Reliability

⌄ Security

Overview

On new code

Vulnerabilities	0
Rating	A
Remediation Effort	0

Overall

Vulnerabilities	14
Rating	D
Remediation Effort	3h 40min

› Maintainability

› Coverage

› Duplications

› Size

› Complexity

› Issues

⌄ OWASP-Dependency-Check

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Inherited Risk Score	9
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Total Dependencies	178
Total Vulnerabilities	5
Vulnerable Component Ratio	1.7%

Leak Period: since 06.00.00

Risk

Color: Worse of Reliability Rating and Security Rating Size: Lines of Code

🟩 A 🟩 B 🟨 C 🟧 D 🟥 E

Get quick insights into the operational risks. Any color but green indicates immediate risks: Bugs or Vulnerabilities that should be examined. A position at the top or right of the graph means that the longer-term health may be at risk. Green bubbles at the bottom-left are best.

DEMO!

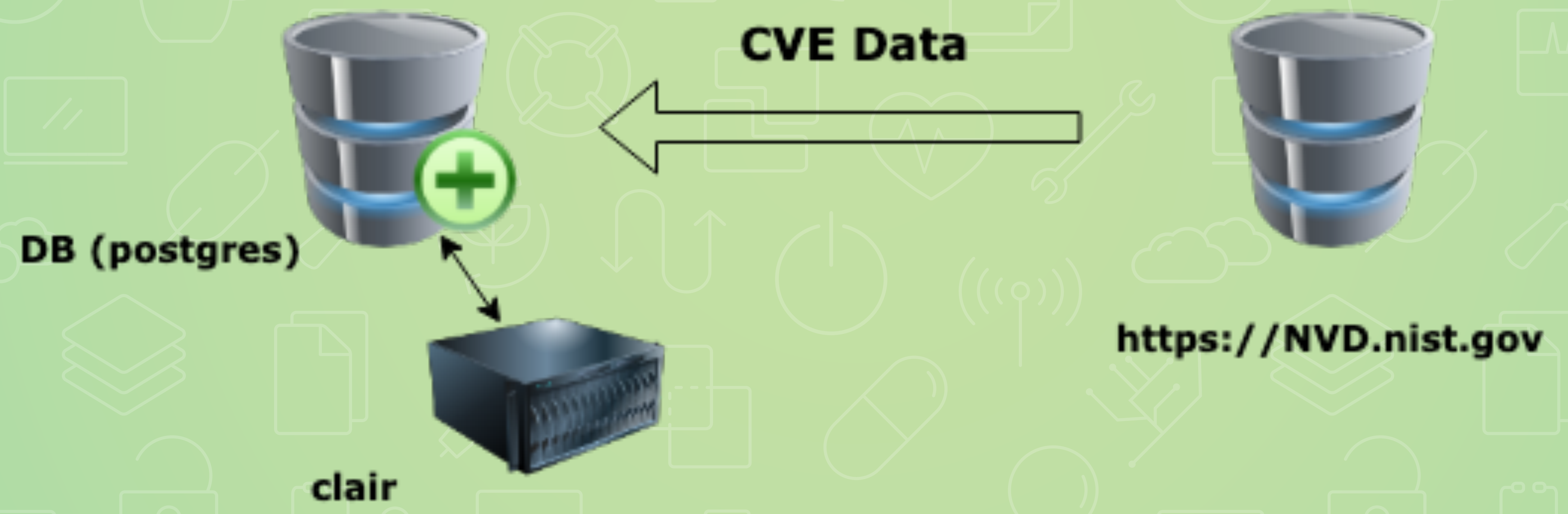
containers

docker pull cy4n/broken

```
FROM cy4n/broken:latest
```

clair

A Container Image Security Analyzer by CoreOS



```
clair-scanner ... <image>
```

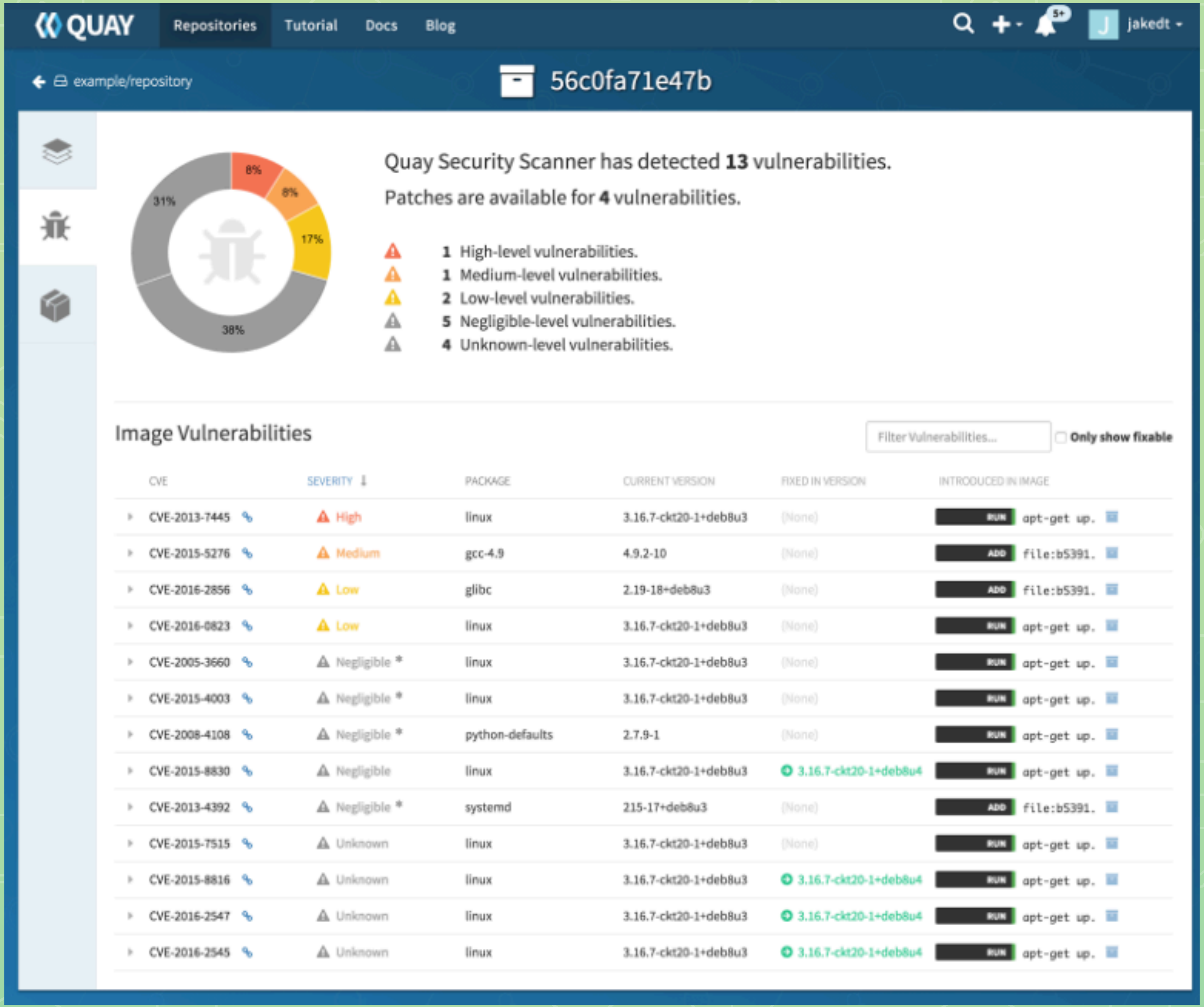
https://github.com/arminc/clair-local-scan

```
docker run -d --name db arminc/clair-db:latest
docker run -p 6060:6060 --link db:postgres -d --name clair arminc/clair-local-scan
```

DEMO!

clair

A Container Image Security Analyzer by CoreOS



56c0fa71e47b

Quay Security Scanner has detected **13** vulnerabilities.

Patches are available for **4** vulnerabilities.

- **1** High-level vulnerabilities.
- **1** Medium-level vulnerabilities.
- **2** Low-level vulnerabilities.
- **5** Negligible-level vulnerabilities.
- **4** Unknown-level vulnerabilities.

Image Vulnerabilities

Filter Vulnerabilities... ☐ Only show fixable

CVE	SEVERITY	PACKAGE	CURRENT VERSION	FIXED IN VERSION	INTRODUCED IN IMAGE
CVE-2013-7445	High	linux	3.16.7-ckt20-1+deb8u3	(None)	RUN apt-get up.
CVE-2015-5276	Medium	gcc-4.9	4.9.2-10	(None)	ADD file:b5391.
CVE-2016-2856	Low	glibc	2.19-18+deb8u3	(None)	ADD file:b5391.
CVE-2016-0823	Low	linux	3.16.7-ckt20-1+deb8u3	(None)	RUN apt-get up.
CVE-2005-3660	Negligible *	linux	3.16.7-ckt20-1+deb8u3	(None)	RUN apt-get up.
CVE-2015-4003	Negligible *	linux	3.16.7-ckt20-1+deb8u3	(None)	RUN apt-get up.
CVE-2008-4108	Negligible *	python-defaults	2.7.9-1	(None)	RUN apt-get up.
CVE-2015-8830	Negligible	linux	3.16.7-ckt20-1+deb8u3	3.16.7-ckt20-1+deb8u4	RUN apt-get up.
CVE-2013-4392	Negligible *	systemd	215-17+deb8u3	(None)	ADD file:b5391.
CVE-2015-7515	Unknown	linux	3.16.7-ckt20-1+deb8u3	(None)	RUN apt-get up.
CVE-2015-8816	Unknown	linux	3.16.7-ckt20-1+deb8u3	3.16.7-ckt20-1+deb8u4	RUN apt-get up.
CVE-2016-2547	Unknown	linux	3.16.7-ckt20-1+deb8u3	3.16.7-ckt20-1+deb8u4	RUN apt-get up.
CVE-2016-2545	Unknown	linux	3.16.7-ckt20-1+deb8u3	3.16.7-ckt20-1+deb8u4	RUN apt-get up.

ools
Help
URL:
http://www.internet.com

API / Webserver

ZAProxy

burp

API / Webserver - dynamic testing

OWASP ZAProxy

url spider

passive (and active) modes

ajax supported

zap2docker

myApp

```
docker run -t owasp/zap2docker-stable zap-baseline.py -t http://<URL>
```

HTTP

DEMO!

how to react?