



OWASP  
Open Web Application  
Security Project

# 用OWASP DependencyTrack管理应用依赖安全

马伟

# 关于我



## 马伟

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# 内容大纲

- 应用依赖安全问题
- 流行的开源依赖安全检查工具
- OWASP DependencyTrack特点解析
- OWASP DependencyTrack使用经验分享
- 总结

# 1.应用依赖安全问题

# 软件供应链

## 狭义定义：

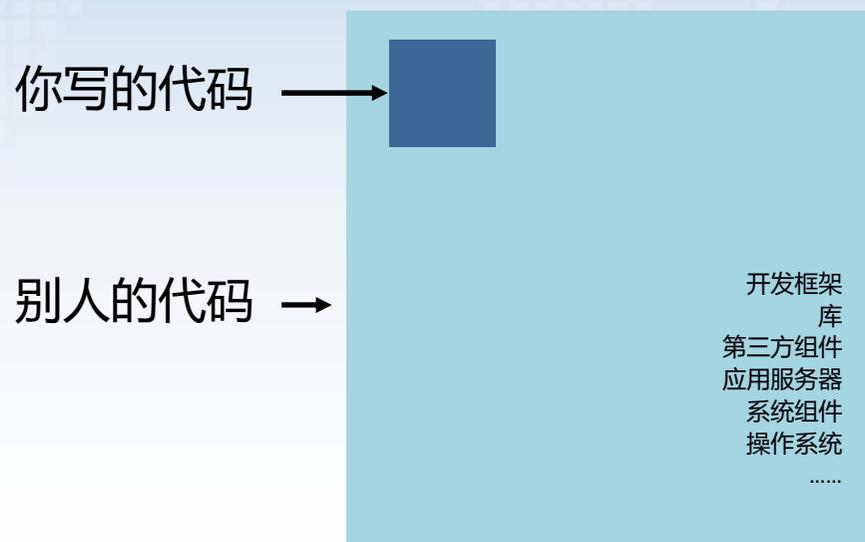
应用程序所使用的依赖、第三方组件

## 广义定义：

在狭义定义下，还包括应用程序所运行的应用服务器、系统组件、操作系统等等，甚至还包括软件设计、研发过程中所使用到的软件，比如IDE

# 约80%的代码不是开发团队写的

而是来自应用程序使用的依赖、第三方组件



# 应用依赖中可能存在的问题

## 依赖中可能含有已知安全漏洞

案例：Apache Tomcat CVE-2020-1938任意文件读取

攻击者可以利用这个漏洞读取或包含 Tomcat 上所有 **webapp** 目录下的任意文件

攻击途径：远程网络	攻击复杂度：低
认证：不需要认证	机密性：完全地
完整性：完全地	可用性：完全地

漏洞评分：10.0

# 应用依赖中可能存在的问题

## 依赖的软件许可协议可能存在法律风险

### 案例：Oracle索赔谷歌88 亿美元的大事件

OpenJDK这个GPL项目的著作权属于Oracle，而当时谷歌工程师直接从OpenJDK复制了9行代码到谷歌的Android项目中。重点在于，Android项目没有按GPL兼容的方式授权，于是触犯了Oracle的著作权，并被要求赔偿88亿美元。

## 2.流行的开源依赖安全检查工具



# 流行的应用程序的依赖检查工具

前端应用：NPM Audit 命令足矣

后端应用（尤其Java/.NET）：

- OWASP DependencyCheck
- OWASP DependencyTrack
- Sonatype OSS Index 工具集合
- Github Dependabot
- .....

# OWASP DependencyCheck

- 识别应用程序依赖是否含有已知安全漏洞
- 多种构建工具支持，如CLI、Maven、Gradle
- 基于NVD漏洞数据库
- 提供HTML报告

# Sonatype OSS Index 工具集合

继OWASP DependencyCheck之后，入选第23期ThoughtWorks技术雷达

Scan your projects for open source vulnerabilities, and build security into your development toolchain with native tools and integrations. The following scan tools all utilize the OSS Index public [REST API](#).

## Java / JVM

- [Maven plugin](#)
- [Gradle plugin](#)
- [Maven Enforcer rules](#)

## Go

- [Nancy](#) scans Golang projects

## .NET

- [Audit.NET](#) scans NuGet projects
- [DevAudit](#) is a cross-platform security auditing tool

## PHP

- [Bach](#) scans Composer projects

## Rust

- [Cargo Pants](#) scans Cargo projects

## Other

- [Sonatype DepShield](#) continuously monitors GitHub projects for vulnerabilities
- [Ahab](#) scans apt and yum operating systems
- [OWASP Dependency-Check](#) is an SCA utility for scanning project dependencies
- [OWASP Dependency-Track](#) is a component analysis platform

## JavaScript

- [AuditJS](#) scans npm projects
- [VS Code plugin](#)

## C/C++

- [Cheque](#) scans C/C++ projects

## Python

- [ossaudit](#) scans Python projects
- [Jake](#) scans Python and Conda projects

## Ruby

- [Chelsea](#) scans Ruby projects

## R

- [oysteR](#) scans R projects



# Github Dependabot

自动创建Pull Request, 一键升级有问题的依赖, 提升开发人员体验

The screenshot shows a GitHub Pull Request interface. At the top, the title is "[Security] Bump sshpk from 1.13.1 to 1.16.1 #23". Below the title, it says "dependabot wants to merge 1 commit into master from dependabot/npm\_and\_yarn/sshpk-1.16.1". The PR is marked as "Open".

The main content of the PR includes a comment from dependabot bot, dated 3 days ago. The comment text is: "Bumps sshpk from 1.13.1 to 1.16.1. This update includes security fixes." Below this, there are expandable sections for "Vulnerabilities fixed", "Release notes", and "Commits". A "compatibility 92%" badge is visible. The comment also states: "Dependabot will resolve any conflicts with this PR as long as you don't alter it yourself. You can also trigger a rebase manually by commenting @dependabot rebase .".

Below the comment, there is a commit link: "[Security] Bump sshpk from 1.13.1 to 1.16.1" with a "Verified" badge and a commit hash "7471864".

At the bottom of the PR, there are two green checkmarks indicating successful checks: "All checks have passed" (1 successful check) and "This branch has no conflicts with the base branch".

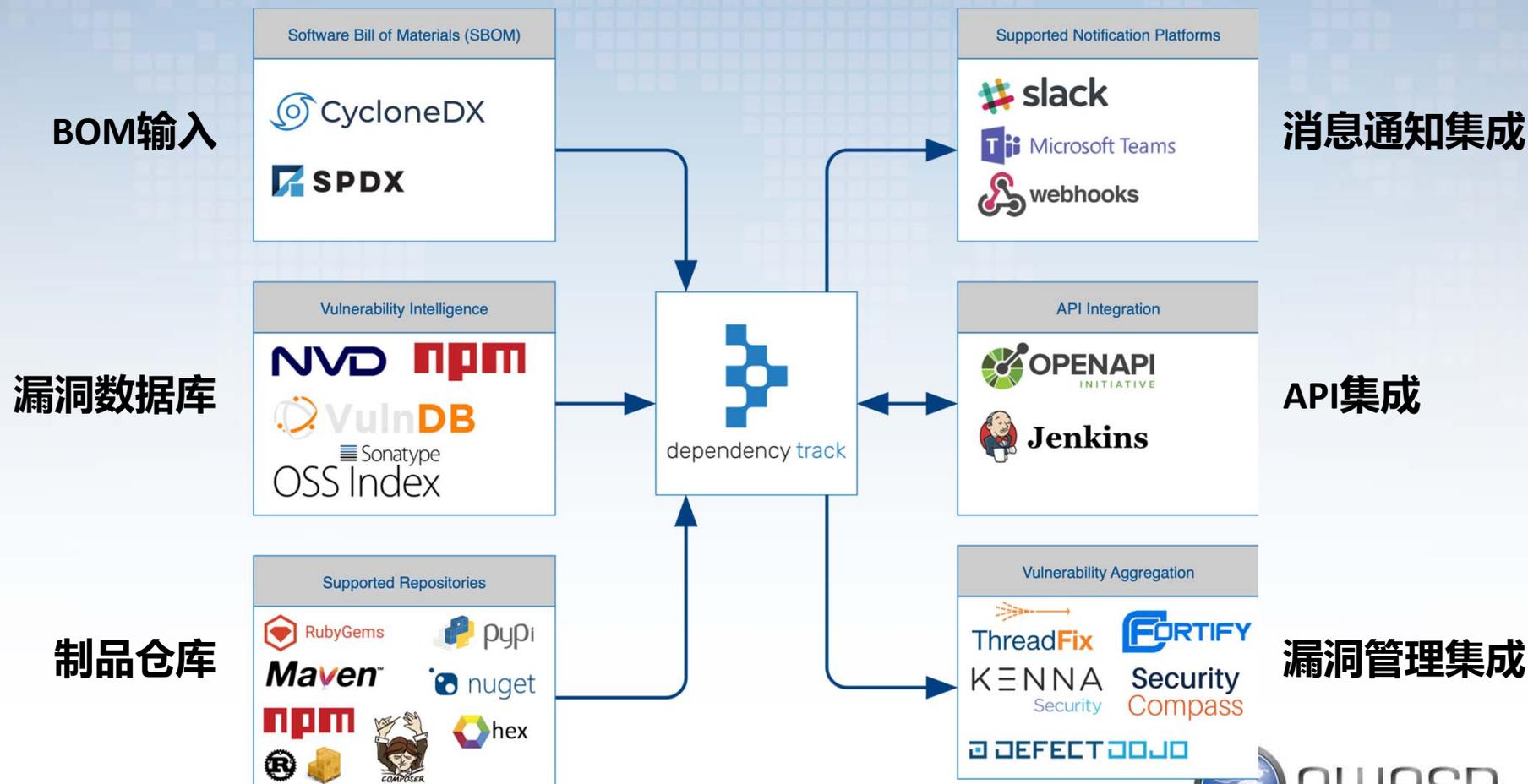
On the right side of the PR, there are sections for "Reviewers" (No reviews), "Assignees" (No one assigned), "Labels" (dependencies, security), "Projects" (None yet), "Milestone" (No milestone), and "Notifications" (Subscribe button).



## 3.OWASP DEPENDENCYTRACK特点解析



# DependencyTrack生态系统



# DependencyTrack 特点解析

- 自动、持续监测依赖安全性
- 多种类的漏洞数据库
- 丰富的可视化功能
- 持续集成友好
- 可通过多种渠道发送告警
- AD/LDAP集成
- 丰富的API
- DependencyCheck和DependencyTrack的区别

# 3.1 自动、持续监测依赖安全性



# 3.1 自动、持续监测依赖安全性

## SBOM(Software Bill of Materials)示例

```
1  {
2    "bomFormat" : "CycloneDX",
3    "specVersion" : "1.2",
4    "serialNumber" : "urn:uuid:9bcaf4b3-c6e2-45a7-be64-...",
5    "version" : 1,
6  > "metadata" : { ...
23    },
24  > "components" : [ ... ←
3248 ],
3249 "xmlns" : "http://cyclonedx.org/bom",
3250 }

172     "purl" : "pkg:maven/org.springframework/spring-expression@5.2.14.RELEASE?type=jar",
173     "modified" : false,
174     "type" : "library"
175   },
176   {
177     "publisher" : "Pivotal Software, Inc.",
178     "group" : "org.springframework.boot",
179     "name" : "spring-boot",
180     "version" : "2.3.10.RELEASE",
181     "description" : "Spring Boot",
182   > "hashes" : [ ...
215   ],
216   > "licenses" : [ ...
227   ],
228     "purl" : "pkg:maven/org.springframework.boot/spring-boot@2.3.10.RELEASE?type=jar",
229     "modified" : false,
230     "type" : "library"
231   },
232   {
233     "group" : "com.fasterxml.jackson.core",
234     "name" : "jackson-databind",
235     "version" : "2.11.4",
```

## 3.2 多种类的漏洞数据库

- National Vulnerability Database
- NPM Public Advisories
- Sonatype OSS Index
- VulnDB

## 3.2 多种类的漏洞数据库

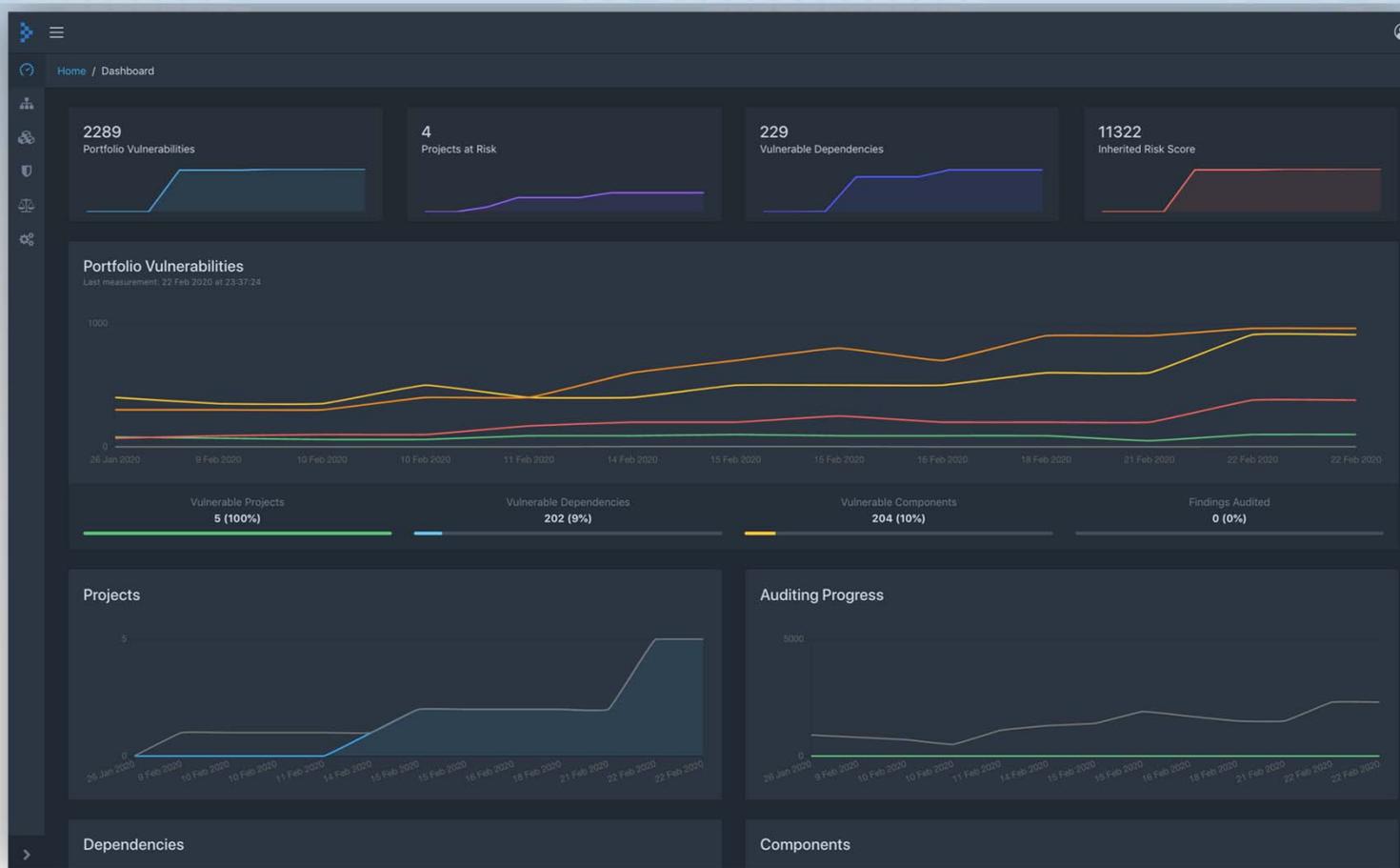
支持多种构建工具、制品库

Ecosystem	Repository	Resolution Order
gem	RubyGems	1
hex	Hex	1
maven	Maven Central	1
	Atlassian Public	2
	JBoss Releases	3
	Clojars	4
	Google Android	5
npm	NPM	1
nuget	NuGet	1
pypi	PyPi	1



## 3.3 丰富的可视化功能

通过仪表盘，可以直观的追踪依赖安全态势



## 3.3 丰富的可视化功能

可从Project视角深入了解、审计当前依赖安全状况

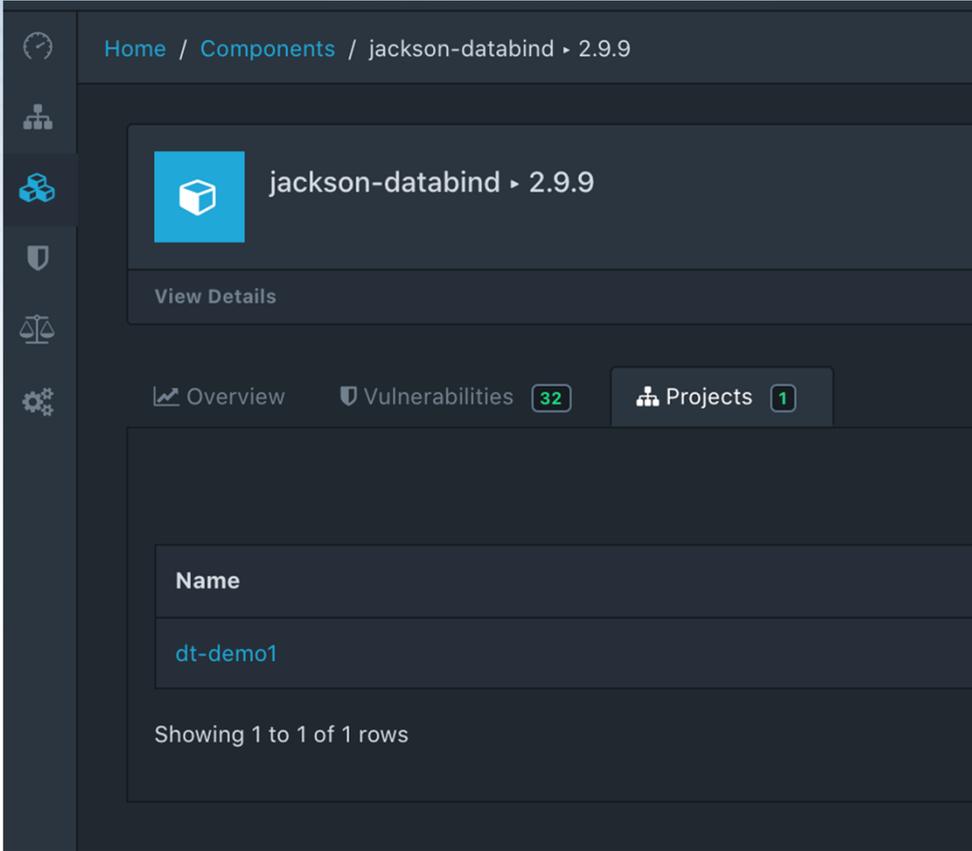
The screenshot displays a security dashboard interface. On the left, a sidebar shows a 'Portfolio Vulnerabilities' section with a count of 39 and a '+ Create Project' button. Below it, a list of project names includes 'dt-demo1' and 'dt-demo2'. The main content area is titled 'dt-demo1' and shows a 'View Details' section with tabs for 'Overview', 'Dependencies', and 'Audit'. A table lists vulnerabilities for the 'jackson-databind' component, version 2.9.9, from the group 'com.fasterxml.jackson.core'. The table columns are Component, Version, Group, Vulnerability, CWE, Severity, Analysis, and Suppressed. The vulnerabilities listed are:

Component	Version	Group	Vulnerability	CWE	Severity	Analysis	Suppressed
jackson-databind	2.9.9	com.fasterxml.jackson.core	<a href="#">NVD CVE-2020-8840</a>	CWE-502 Deserialization of Untrusted Data	Critical		
jackson-databind	2.9.9	com.fasterxml.jackson.core	<a href="#">NVD CVE-2019-14379</a>	CWE-915 Improperly Controlled Modification ...	Critical		
jackson-databind	2.9.9	com.fasterxml.jackson.core	<a href="#">NVD CVE-2019-20330</a>	CWE-502 Deserialization of Untrusted Data	Critical		
jackson-databind	2.9.9	com.fasterxml.jackson.core	<a href="#">NVD CVE-2019-16942</a>	CWE-502 Deserialization of Untrusted Data	Critical		
jackson-databind	2.9.9	com.fasterxml.jackson.core	<a href="#">NVD CVE-2019-14893</a>	CWE-502 Deserialization of Untrusted Data	Critical		
jackson-databind	2.9.9	com.fasterxml.jackson.core	<a href="#">NVD CVE-2019-16943</a>	CWE-502 Deserialization of Untrusted Data	Critical		
jackson-databind	2.9.9	com.fasterxml.jackson.core	<a href="#">NVD CVE-2019-17631</a>	CWE-502 Deserialization of Untrusted Data	Critical		
jackson-databind	2.9.9	com.fasterxml.jackson.core	<a href="#">NVD CVE-2019-14540</a>	CWE-502 Deserialization of Untrusted Data	Critical		
jackson-databind	2.9.9	com.fasterxml.jackson.core	<a href="#">NVD CVE-2020-9548</a>	CWE-502 Deserialization of Untrusted Data	Critical		
jackson-databind	2.9.9	com.fasterxml.jackson.core	<a href="#">NVD CVE-2019-14892</a>	CWE-502 Deserialization of Untrusted Data	Critical		

At the bottom of the table, it says 'Showing 1 to 10 of 39 rows' and '10 rows per page'. On the right side of the dashboard, there are several charts and a section titled 'Inerabilities' (likely a typo for 'Inherabilities') showing a bar chart with values 15, 21, and 3, and a line graph above it.

## 3.3 丰富的可视化功能

最好用功能：方便排查某含有已知安全漏洞的第三方组件被哪些项目或开发团队使用了



The screenshot displays the OWASP Dependency-Track web interface. The breadcrumb navigation at the top reads 'Home / Components / jackson-databind ▾ 2.9.9'. The main content area shows the component 'jackson-databind ▾ 2.9.9' with a 'View Details' button. Below this, there are three tabs: 'Overview', 'Vulnerabilities 32', and 'Projects 1'. The 'Projects' tab is active, showing a table with one row:

Name
dt-demo1

At the bottom of the table, it says 'Showing 1 to 1 of 1 rows'.

# 3.4 持续集成友好

通过Jenkins插件，可以方便的将SBOM信息提交给DependencyTrack,以及查看扫描结果

The screenshot shows the Jenkins interface for 'Project Acme Example'. On the left is a sidebar with navigation options like 'Back to Dashboard', 'Status', 'Changes', 'Workspace', 'Build Now', 'Delete Project', and 'Configure'. Below this is a 'Build History' table with columns for build number, time, and status. The main area displays 'Project Acme Example' with a 'Workspace' icon and 'Recent Changes'. A 'Dependency-Track Trend' graph is shown, plotting 'vulnerabilities' (y-axis, 0-18) against build numbers (x-axis, #37-#44). The graph has four series: Critical (red), High (orange), Medium (yellow), and Low (green). A legend indicates counts: Critical: 5, High: 10, Medium: 16, Low: 2.

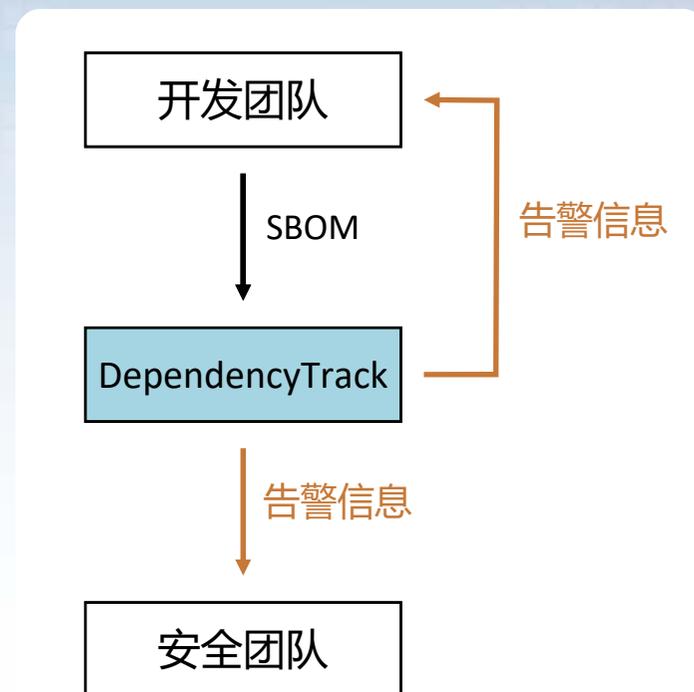
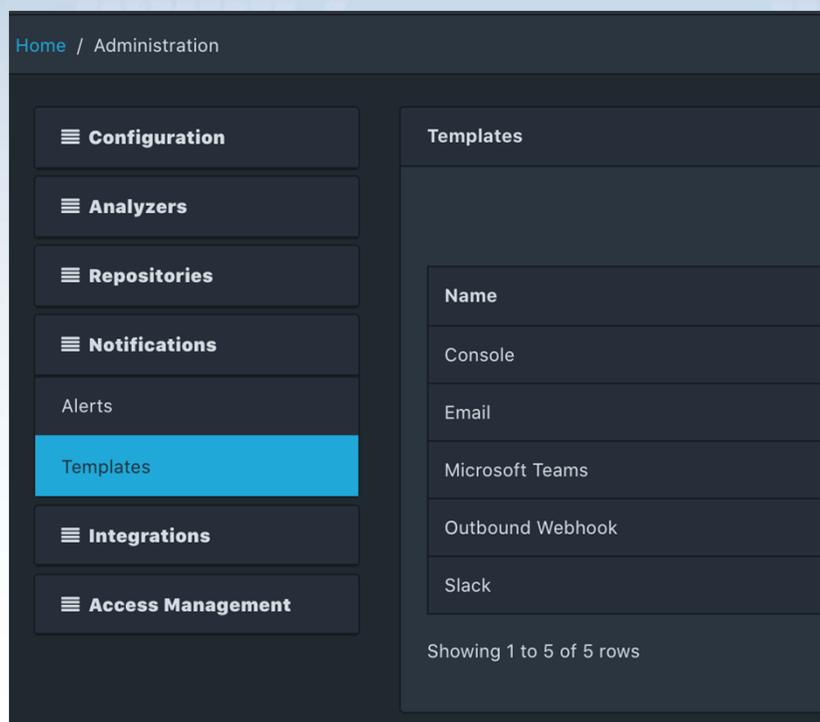
The screenshot shows the 'Dependency-Track Results' page in Jenkins. It features a 'SEVERITY DISTRIBUTION' bar chart and a table of vulnerabilities. Below the table is a detailed view for the 'growl' vulnerability.

Name	Version	Group	Vulnerability	Severity	CWE
+ timespan	2.3.0		NPM 533	Low	CWE-400 Uncontrolled Resource Con...
+ uglify-js	2.4.24		NPM 48	Low	CWE-400 Uncontrolled Resource Con...
+ adm-zip	0.4.4		NPM 681	High	CWE-29 Path Traversal: '\\.\\filename'
+ hoek	2.16.3		NPM 566	Medium	CWE-471 Modification of Assumed-I...
- growl	1.9.2		NPM 146	Critical	CWE-94 Improper Control of Generati...

**Title:** Command Injection  
**Subtitle:** growl  
**Description:** Affected versions of 'growl' do not properly sanitize input prior to passing it into a shell command, allowing for arbitrary command execution.  
**Recommendation:** Update to version 1.10.2 or later.  
**Analysis:**

## 3.5 可通过多种渠道发送告警

- 支持Email、Microsoft Teams、Slack等提醒

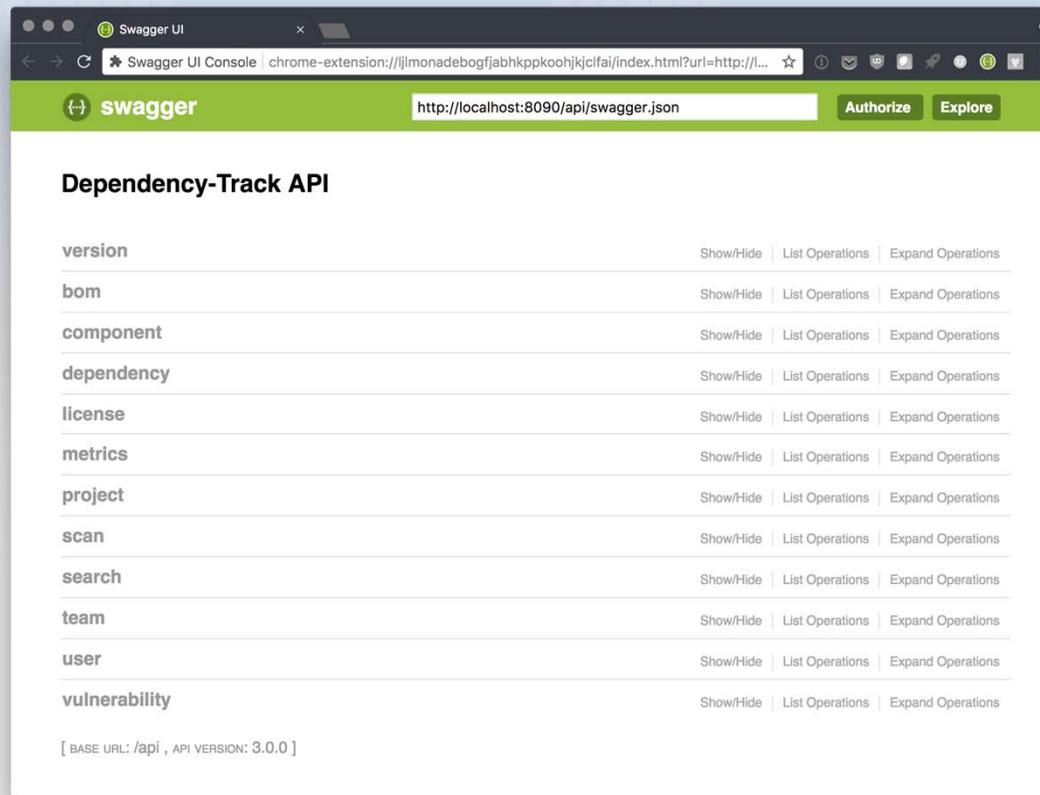


## 3.6 AD/LDAP集成

- 支持多种类型的LDAP服务集成例如
  - Microsoft Active Directory
  - ApacheDS
  - Fedora 389 Directory
  - NetIQ/Novell eDirectory

## 3.7 丰富的API

- DependencyTrack从设计上遵循API First原则，因此开发团队、安全团队可以调用API以实现自己的定制化需求



## 3.8 DependencyTrack和DependencyCheck的区别?

	DependencyCheck	DependencyTrack
一句话描述	依赖安全检测工具	软件安全供应链管理平台
目标用户	开发团队	安全团队 / 开发团队
漏洞数据库	<b>只有NVD漏洞数据库</b>	集成多种漏洞数据库, NVD是其中之一, 还有OSSIndex、NPM等
持续集成	支持, 但需要一定程度的自定义配置以提升扫描效率	支持, 且配置简单
最佳使用阶段	开发过程中使用	开发过程中, 以及安全运营阶段皆可使用
License安全检测	<b>不支持</b>	支持
趋势追踪	<b>不支持</b>	支持
漏洞提醒	<b>不支持</b>	支持
依赖分析、排查	仅支持单个团队做自我分析、排查	可以方便的集中分析、排查所有团队的依赖

## 4.OWASP DEPENDENCYTRACK使用经验分享



# OWASP DependencyTrack使用经验分享

- 用DependencyTrack检查依赖安全问题
- 配置消息通知
- 实用小提示
- 推动开发团队思维模式转变

## 4.1 用DependencyTrack检查依赖安全问题

- 基本步骤：
  1. 生成SBOM
  2. 提交SBOM到DependencyTrack
  3. 在DependencyTrack中查看扫描结果

# 步骤1：生成SBOM

DependencyTrack支持并推荐使用CycloneDX BOMs

以Gradle构建工具为例，引入CycloneDX插件来生成SBOM

```
build.gradle
1  plugins {
2      id 'org.springframework.boot' version '2.3.10.RELEASE'
3      id 'io.spring.dependency-management' version '1.0.11.RELEASE'
4      id 'java'
5      id "org.cyclonedx.bom" version "1.3.0"
6  }
```

# 步骤1：生成SBOM

## CycloneDX Gradle Plugin 1.2.0版本的安装

```
buildscript {  
    repositories {  
        mavenCentral()  
        maven {  
            url "https://jitpack.io"  
        }  
    }  
    dependencies {  
        classpath "com.cyclonedx:cyclonedx-gradle-plugin:1.2.0"  
    }  
}  
  
apply plugin: "org.cyclonedx.bom"
```

1.2.0版本需自定义其所在Maven仓库地址，否则无法安装

# 步骤2：提交SBOM到DependencyTrack

推荐使用Jenkins Plugin，配置简单，示例步骤如下

1.在DependencyTrack中，为开发团队创建账号并生成API Key

Home / Administration

- Configuration
- Analyzers
- Repositories
- Notifications
- Integrations
- Access Management
  - LDAP Users
  - Managed Users
  - Teams**
  - Permissions

### Teams

[+ Create Team](#)

Team Name	API Ke
Administrators	0
Automation	1
Portfolio Managers	0
dev team 1	1

Team Name \*

dev team 1 ✓

API Keys

HOU [REDACTED] hXou

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# 步骤2：提交SBOM到DependencyTrack

2.作为开发团队，配置Jenkins, 设置DependencyTrack的服务器地址及API Key

Dependency-Track	
Dependency-Track URL	<input type="text" value="http://172.17.0.2:8080"/>
API key	<input type="text" value="HOU [REDACTED] ZhXou"/>
Polling Timeout	<input type="text" value="5"/>
Auto Create Projects	<input type="checkbox"/>

# 步骤2：提交SBOM到DependencyTrack

## 3.配置Job运行cyclonedxBom命令

### Invoke Gradle script

Invoke Gradle

Use Gradle Wrapper

Make gradlew executable

Wrapper location

Tasks

## 4.配置Job，设置要上传的bom.xml文件的路径

### Post-build Actions

#### Publish BOM to Dependency-Track

Dependency-Track project

Artifact

Enable synchronous publishing mode

[Risk Gate Thresholds...](#)

[Add post-build action ▾](#)

## 步骤2：提交SBOM到DependencyTrack

### 也可以通过REST API提交SBOM

1. 将步骤1生成的SBOM文件base64编码
2. 按以下格式准备请求payload，将上一步编码后的内容填入bom字段

```
{ } bom-payload.json > ...  
1  {  
2    "project": "5fd26ff7-3ff7-420f-b4b6-77a106166f6c",  
3    "projectName": "d[REDACTED]1",  
4    "projectVersion": "1.3.17",  
5    "autoCreate": false,  
6    "bom": "ewogICJib21Gb3JtYXQi.....vbS8xLjIiCn0="
```

## 步骤2：提交SBOM到DependencyTrack

也可以通过REST API提交SBOM

3. 通过curl等命令按以下格式发送请求

```
1 curl -X "PUT" "http://<HOST>:<PORT>/api/v1/bom" \  
2     -H 'Content-Type: application/json' \  
3     -H 'X-API-Key: <API KEY>' \  
4     -d @bom-payload.json
```

# 步骤3：在DependencyTrack中查看扫描结果

The screenshot displays the DependencyTrack interface for a project named 'dt-demo1'. At the top right, there are five circular indicators representing different metrics: 15 (red), 21 (orange), 3 (yellow), 0 (green), and 0 (grey). Below these, the 'View Details' link is visible. The main navigation bar includes 'Overview', 'Dependencies' (with a count of 36), and 'Audit' (with a count of 39). A search bar and a refresh button are also present.

Component	Version	Group	Vulnerability	CWE	Severity	Analysis	Suppressed
jackson-databind	2.9.9	com.fasterxml.jackson.core	NVD CVE-2020-8840	CWE-502 Deserialization of Untru...	Critical		
jackson-databind	2.9.9	com.fasterxml.jackson.core	NVD CVE-2020-11620	CWE-502 Deserialization of Untru...	High		
jackson-databind	2.9.9	com.fasterxml.jackson.core	NVD CVE-2020-11619	CWE-502 Deserialization of Untru...	High		
jackson-databind	2.9.9	com.fasterxml.jackson.core	NVD CVE-2019-14379	CWE-915 Improperly Controlled ...	Critical		
jackson-databind	2.9.9	com.fasterxml.jackson.core	NVD CVE-2019-20330	CWE-502 Deserialization of Untru...	Critical		
jackson-databind	2.9.9	com.fasterxml.jackson.core	NVD CVE-2019-16942	CWE-502 Deserialization of Untru...	Critical		
jackson-databind	2.9.9	com.fasterxml.jackson.core	NVD CVE-2019-14893	CWE-502 Deserialization of Untru...	Critical		
jackson-databind	2.9.9	com.fasterxml.jackson.core	NVD CVE-2019-12384	CWE-502 Deserialization of Untru...	Medium		
jackson-databind	2.9.9	com.fasterxml.jackson.core	NVD CVE-2019-14439	CWE-502 Deserialization of Untru...	High		
jackson-databind	2.9.9	com.fasterxml.jackson.core	NVD CVE-2019-16943	CWE-502 Deserialization of Untru...	Critical		

Showing 1 to 10 of 39 rows | 10 rows per page | Page 1 of 4

## 4.2 配置消息通知（邮件通知为例）

### 1.配置SMTP服务

**Email**

Enable email

From email address  
[redacted]@163.com

SMTP server  
smtp.163.com

SMTP server port  
25

SMTP username  
[redacted]@163.com

SMTP password  
.....

x Enable SSL/TLS encryption

x Trust the certificate provided by the SMTP server

[Update](#) [Configuration Test](#)

### 2.在Notifications > Alerts 菜单下新建一个Alert

**Create Alert**

Name  
Email alert

Scope  
Portfolio

Notification level  
Informational

Publisher  
Email

[Close](#) [Create](#)

## 4.2 配置消息通知（邮件通知为例）

3.配置Alert, 填入需要接受邮件提醒的邮箱地址, 并选择相应的Scope

Alerts

+ Create Alert Search [Refresh]

Name	Publisher	Scope	Notification level
Email alert	Email	PORTFOLIO	INFORMATIONAL

Name \*  
Email alert ✓

Publisher class  
org.dependencytrack.notification.publisher.SendMailPublisher

Notification level  
INFORMATIONAL

Destination \*  
@qq.com ✓

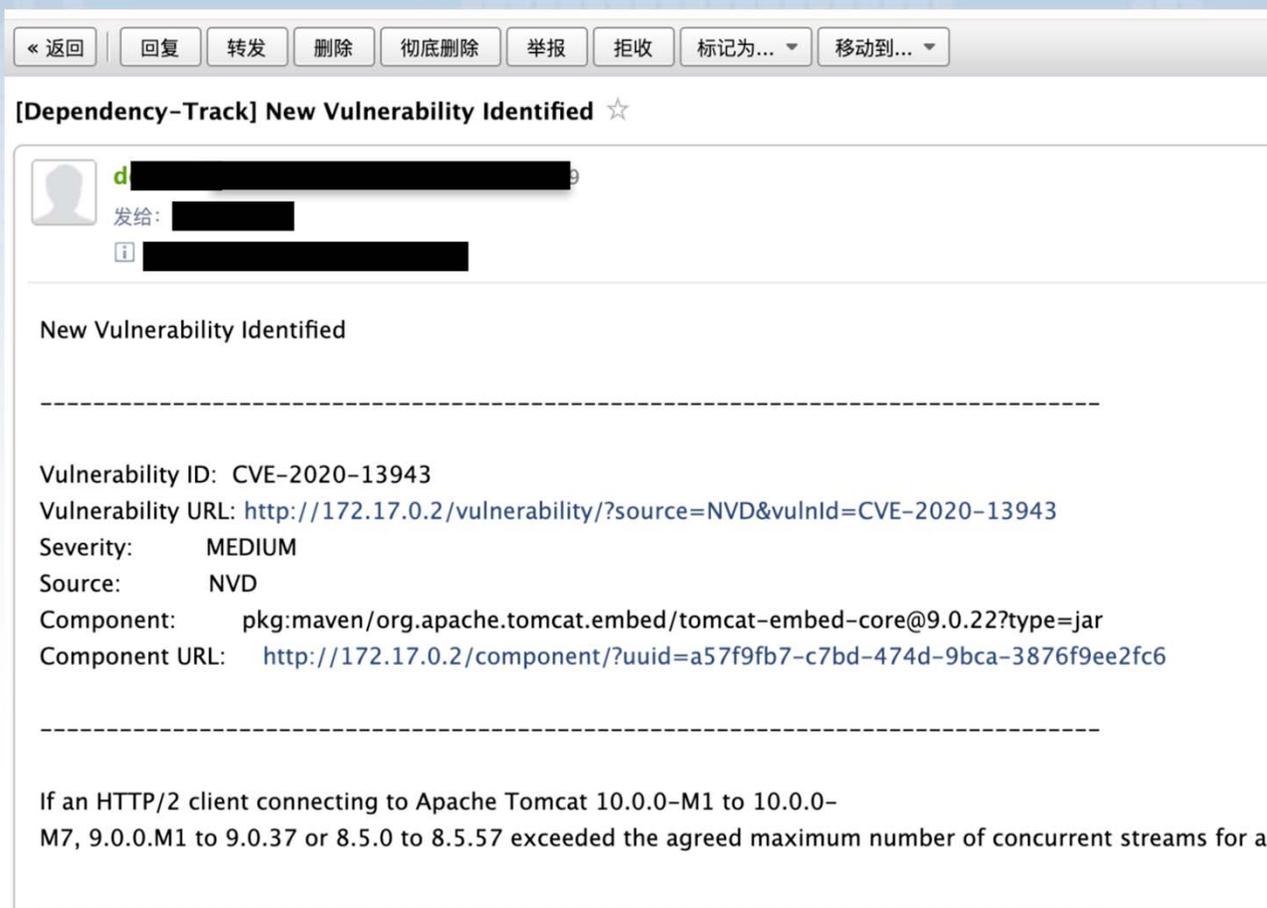
Scope  
PORTFOLIO

Scope  
 NEW\_VULNERABILITY  
 NEW\_VULNERABLE\_DEPENDENCY  
 GLOBAL\_AUDIT\_CHANGE  
 PROJECT\_AUDIT\_CHANGE  
 BOM\_CONSUMED  
 BOM\_PROCESSED

Limit To Delete Alert

## 4.2 配置消息通知（邮件通知为例）

只要DependencyTrack发现有安全问题，则刚才配置的邮箱就能接受到提醒



## 4.2 配置消息通知（其他类型通知）

在创建Alert时选择对应类型，随后在Destination中填入对应信息即可

The 'Create Alert' form includes the following fields and options:

- Name \***: An empty text input field.
- Scope**: A dropdown menu with 'Portfolio' selected.
- Notification level**: A dropdown menu with 'Informational' selected.
- Publisher**: A list of options including Console, Email, Microsoft Teams, Outbound Webhook, and Slack (which is highlighted).

Name	Publisher	Scope	Notification level
Portal Vulnerability Alert	Slack	PORTFOLIO	INFORMATIONAL

The detailed configuration form includes:

- Name \***: Portal Vulnerability Alert (with a green checkmark)
- Scope**: PORTFOLIO
- Publisher class**: org.dependencytrack.notification.publisher.SlackPublisher
- Notification level**: INFORMATIONAL
- Destination \***: https://hooks.slack.com/services/TBD4N325P/BBESP1HM5/ (with a green checkmark)
- Limit to projects**: Acme Portal (with a trash icon and a plus icon to add more)
- Scope checkboxes**:
  - NEW\_VULNERABILITY
  - NEW\_VULNERABLE\_DEPENDENCY
  - GLOBAL\_AUDIT\_CHANGE
  - PROJECT\_AUDIT\_CHANGE
  - BOM\_CONSUMED
  - BOM\_PROCESSED
- Buttons**: Limit To (with an up arrow) and Delete Alert

## 4.3 实用小提示

- 开启Sonatype OSS Index Analyzer以提高检测准确性
- DependencyCheck 报告分析支持功能已经在3.7版本里彻底移除，不要再费力寻找上传DependencyCheck报告的地方了
- 如果你不用Jenkins，那么很可能会遇到上传SBOM的API接口行为和API文档描述不符的情况
- DependencyTrack 4.0版本是一次重大升级，不兼容旧版本的直接升级

## 4.4 推动开发团队思维转变

### 常见误区1:

依赖很少变化，不用频繁检测和升级

### 但其实:

虽然依赖很少变化，但依赖的漏洞随时可能出现，因此也需要在第一时间得到告警信息并进行处理

### 常见误区2:

上线前做一次扫描就够了

### 但其实:

技术债还起来会很痛苦，尽可能保持依赖总是处于最新版本，反而维护成本更低

# 5.总结

# 总结

- 软件供应链安全问题
  - 含有安全漏洞
  - 软件协议安全
- 流行的开源依赖安全检查工具
  - NPM Audit
  - OWASP DependencyCheck & DependencyTrack
  - Sonatype OSS Index 工具集合
  - Github Dependabot
- OWASP DependencyTrack特点解析
- OWASP DependencyTrack使用经验分享

分享到此结束

谢谢