Security Training for Developers

Part 2: Section 5: Software Bill of Materials (SBOM)

- What is an SBOM?
  - Why we need them?
    - How to generate an SBOM for your project?
  - SCA Platforms
- Early Adopters at EF

What is an SBOM?

SBOM

Inventory of

1. **software components** and **dependencies**
2. component **metadata**
3. and their **hierarchical relationships**

of a **software product.**

Chocolate Chip Cookies

Ingredients:

- Flour (all-purpose/ 2 cups)
- Sugar (granulated/ 1 cup)
- Brown sugar (regular/ ½ cup)
- Butter (unsalted/ 1 stick)
- Eggs (large/ 2)
- Vanilla extract (pure/ 1tsp)
- Baking soda (regular/ 1tsp)
- Salt (regular/ ½ tsp)
- Chocolate Chips (loads/ 1 cup)

meal = software product

Chocolate Chip Cookies → Task Management App

Ingredients:

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Task Management App

Software Components

- Front-end framework
- UI library
- Utility library
- State management
- Authentication
- Logging
- Bundler
- Security middleware
- Third-party plugins

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Task Management App

quantities, types = component metadata

Components

- Front-end framework: React (18.2.0/MIT)
- UI library: Material-UI (5.4.4/MIT)
- Utility library: Lodash (4.17.21/MIT)
- State management: Redux (4.2.0/MIT)
- Authentication: OAuth2 (3.1.0/Apache-2.0)
- Logging: Winston (3.8.2/MIT)
- Bundler: Webpack (3.8.2/MIT)
- Security middleware: Helmet.js (6.0.0/MIT)
- Third-party plugins: calendar (various)

Chocolate Chip Cookies

Steps

1. For **dough** mix flour, eggs and butter together
2. For **filling** mix chocolate chips, sugar and vanilla extract

Chocolate Chip Cookies

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Task Management App

Transitive dependencies

- The **front-end framework** depends on react, webpack, redux
- The **database** relies on openssl, zlib, libcurl, protobuf

Chocolate Chip Cookies

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steps to mix ingredient

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hierarchical relationships

RECIPE

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Steps

1. The **dough** is made by mixing flour, eggs and butter together
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SBOM

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SBOM

Inventory of **software components** and **dependencies** component **metadata** and their **hierarchical relationships** of a **software product.**

- Unique identifiers for dependencies
- Formats: **SPDX**, **CycloneDX**
- File formats: **JSON, XML, YAML**
- Generation depends on **ecosystem**, lots of tools available
- Optional phase in SDLC - **build** time
  - Accuracy: Captures exact dependencies used during the build
  - Integrates seamlessly in CI/CD pipelines

Why we need them?

Software Supply Chain Security

- Software supply chains are major attack surface
- Modern apps use hundreds of third-party components
- Vulnerabilities often hide in dependencies
- The compromise of a dependency can lead to the compromise of the software that is using it

Compliance

- Tool for user self-evaluation
  - Know what's inside the software that you are using
- U.S. Executive Order 14028
  - Requires SBOMs for software sold to US federal agencies
  - Enforced via NIST and other federal procurement rules
- EU Cyber Resilience Act (CRA)
  - Applies to software/hardware marketed in the EU
  - Vendors must provide SBOMs and vulnerability handling processes

How to generate an SBOM for your project?

Ask yourself these questions:

Ask yourself these questions:

1. How many products are in my project?
   Example: frontend, backend, multiple packages…
2. How can I integrate it into existing CI/CD pipelines?
   Example: Github Actions workflows, …
3. What is the release process?
   Example: Github Releases, git tags, …
4. Which tool to use?
   Depends on ecosystem: maven, gradle, python, npm, yarn…
   Tooling options at: https://eclipse-csi.github.io/security-handbook/sbom/tooling.html
5. Where do we want to publish it?
   Example: artifacts, DependencyTrack instance

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5. Where do we want to publish it?
   Example: artifacts, **DependencyTrack instance -> What is that?**

Software Composition Analysis (SCA) Tools

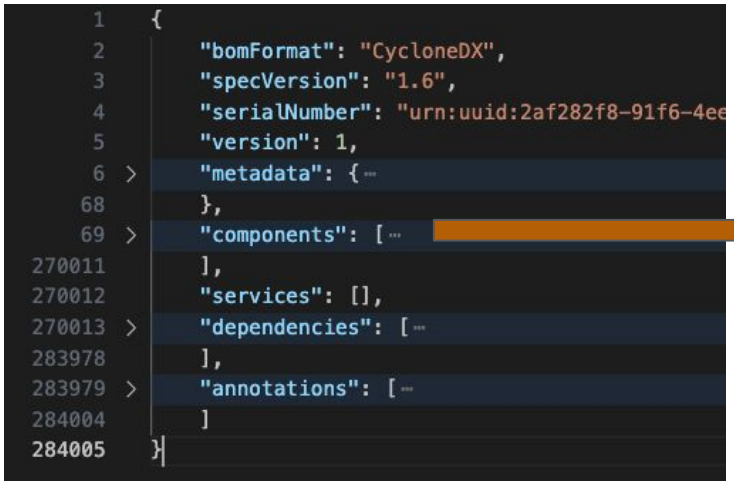
Why we need them?

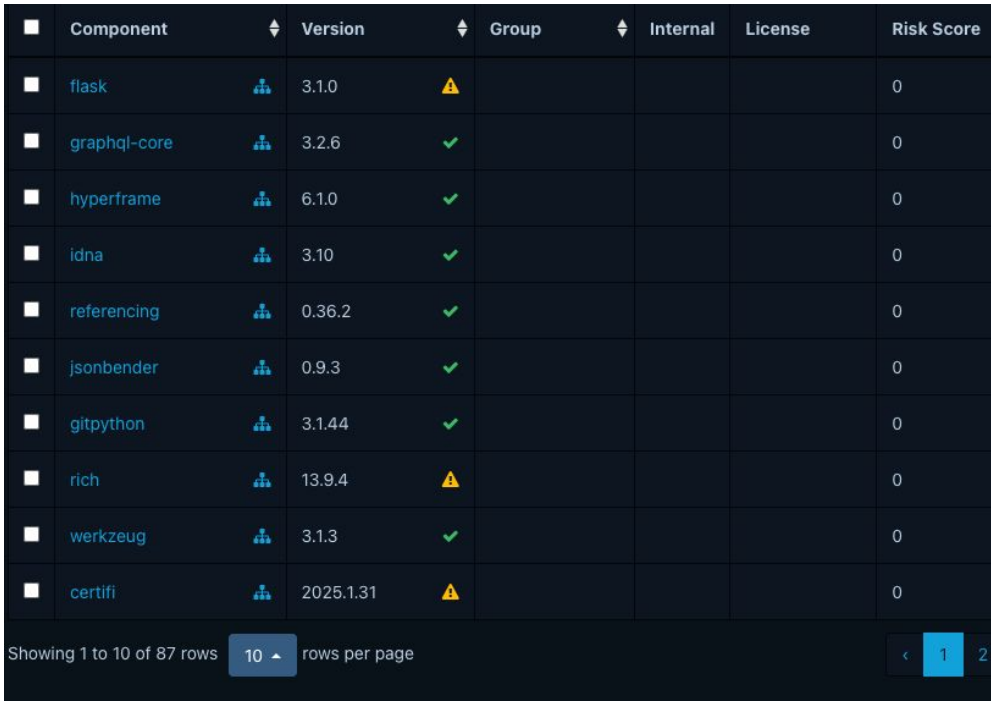
- SBOMs are … really lengthy files …

difficult to analyse

Why we need them?

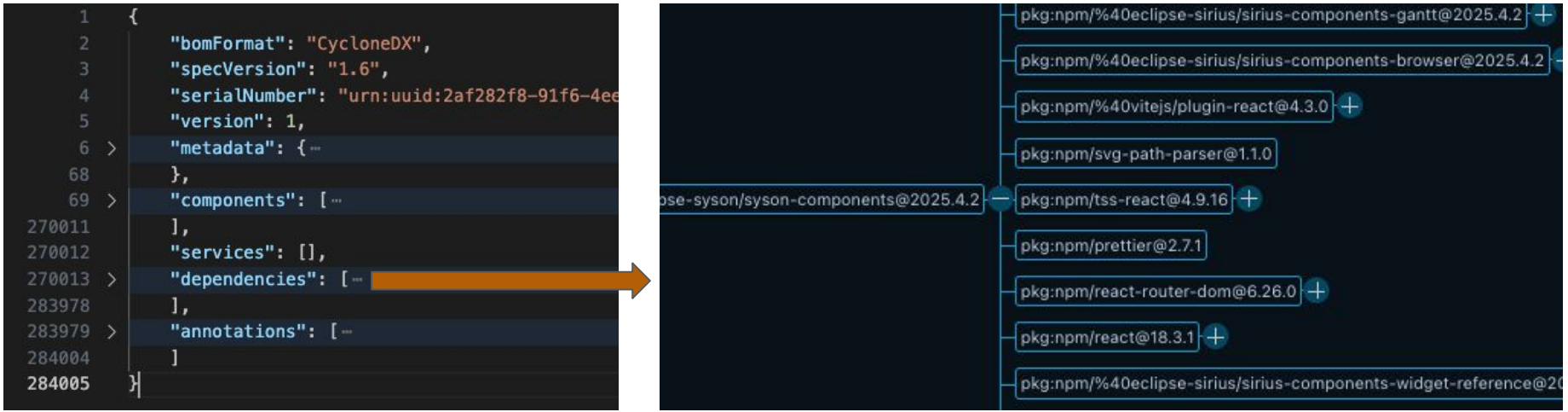
- Components overview





Why we need them?

- Dependency tree visualization



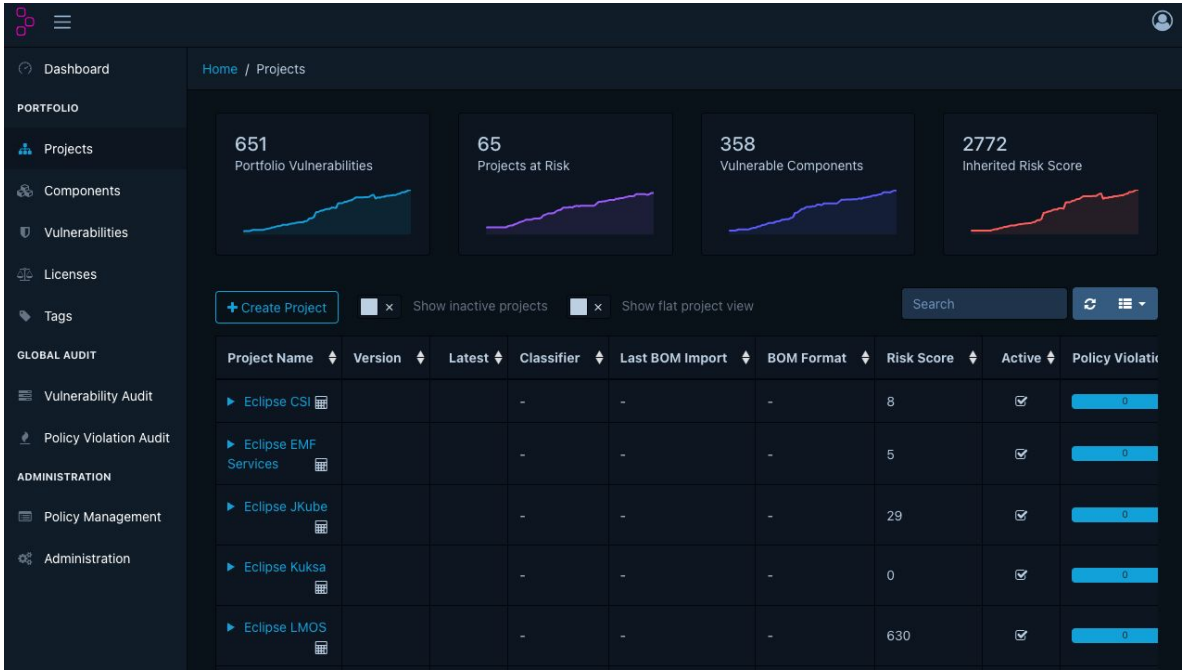
Why we need them?

- Vulnerability data enrichment
- Alerts on vulnerable dependencies

	Component	Version	Group	Vulnerability	Severity	Analyzer	Attributed On
>	esbuild	0.20.2		GITHUB GHSA-67mh-4wv8-2f99	Medium	GITHUB	13 May 2025
>	vitest	1.6.0		GITHUB GHSA-9crc-q9x8-hgqq	Critical	GITHUB	13 May 2025
>	vite	5.2.11		GITHUB GHSA-64vr-g452-qvp3	Medium	GITHUB	13 May 2025

EF DependencyTrack instance

- Link: https://sbom.eclipse.org
- Login with EF account credentials



Upload integration

- Append this job at the end of your SBOM generation workflow:

```
store-sbom-data:
  needs: ['generate-sbom']
  uses: eclipse-csi/workflows/.github/workflows/store-sbom-data.yml@ma
  with:
    projectName: '<product_name>' # display name
    projectVersion: ${{ needs.generate-sbom.outputs.project-version }}
    bomArtifact: '<artifact_name>' # name from upload in generate-sbom
    bomFilename: 'bom.json'
    parentProject: '<parentProject_ID>' # provisioned by us
```

- More about it at: https://eclipse-csi.github.io/security-handbook/sbom/howto.html#how-to-upload-an-sbom-to-dependencytrack

SBOMs Early Adopters at Eclipse Foundation

ECLIPSE FOUNDATION

SBOM Early Adopters

- **Early Adopters:** *Implementing Software Bill of Materials (SBOM) for projects*
  - Support in equipping projects with:
    - Github Actions workflows to generate SBOMs for new releases
    - Upload them to our DependencyTrack instance

- How we do that?
  - Fork one of your repositories
  - Design and implement an SBOM workflow
  - Integrate it into existing release process
  - PR for your review

Early Adopters Projects at EF

PROJECT	ECOSYSTEM	WORKFLOW
Eclipse CSI	python	https://github.com/eclipse-csi/otterdog/blob/main/.github/workflows/generate-sbom.yml
Eclipse SysON	nodejs, maven	https://github.com/eclipse-syson/syson/blob/main/.github/workflows/generate-npm-sbom.yml https://github.com/eclipse-syson/syson/blob/main/.github/workflows/generate-maven-sbom.yml
Eclipse Kuksa	python	https://github.com/eclipse-kuksa/kuksa-python-sdk/blob/main/.github/workflows/generate-python-sbom.yml
Eclipse LMOS	gradle	https://github.com/eclipse-lmos/arc/blob/main/.github/workflows/generate-gradle-sbom.yml
Eclipse JKube	maven	https://github.com/eclipse-jkube/jkube/blob/master/.github/workflows/generate-maven-sbom.yml

How to become an early adopter

- We currently have a queue of projects that we help with implementing **Github Actions workflows**

- Email security@eclipse-foundation.org if you would like to be added
  - Subject: “SBOM Early Adopters”
  - Provide project context
    - Number of products in repository
    - Ecosystems
    - Versioning
    - Release process
    - CI/CD pipelines

Future Goals

- SBOM Registry for all EF projects
- Reusable workflow templates collection
- Enriched resources library

Resources

Readings

- Introduction to SBOMs: https://eclipse-csi.github.io/security-handbook/sbom/introduction.html
- How to generate and upload SBOMs: https://eclipse-csi.github.io/security-handbook/sbom/howto.html
- Tooling ecosystem for CycloneDX: https://eclipse-csi.github.io/security-handbook/sbom/tooling.html
- SBOM Registry: https://eclipse-csi.github.io/security-handbook/sbom/registry.html
- SBOM Early Adopters: https://eclipse-csi.github.io/security-handbook/sbom/earlyadopters.htm