Understanding and Managing the Dependency in SBOM with the New Feature of SW360

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2023.02.05
Who is presenting?

Kouki Hama

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- Researches open source compliance, management process, and these tools.
- One of the co-leader of the Eclipse SW360 project.
01

What is SW360?
What is SW360?

SW360 is an open-source software project licensed under the EPL-2.0 that provides both a web application and a repository to collect, organize and make available information about software components. It establishes a central hub for software components in an organization.

SW360 allows for

- tracking components used by a project/product,
- assessing security vulnerabilities,
- maintaining license obligations,
- enforcing policies, and
- generating legal documents.

https://www.eclipse.org/sw360/about/
Overview

SW360 is a 3rd party software component catalogue
Assigns 3rd party and own components to products or projects

• Goals and Benefits
  • Reuse information about components
  • Coordinate product documentation process
  • Supports OSS license clearing
Handling of Software Components

- IT today talks about components
- Involving different systems

Diagram:
- License Scanner
- Artefact Repository
- Source Code Scanner
- Code Quality Checker
- Project BOM Management
Solution: Centralise mappings

- “Phonebook for Components”
- Central database for names for components
- Systems to talk to each other
- Like person directory for IT systems in company already
Example of SW360’s registration Items for Software component

- Component Name
- Categories
- Component Type
- Languages
- Software Platforms
- Operating System
- Vendors
- Main Licenses
- Programming Languages
- Operating Systems
- CPE ID
- Software Platforms
- Release Date
- Download URL

WIP: Support for SPDX (GUI, Import, Export...) 
  - [https://github.com/eclipse/sw360/pull/1682](https://github.com/eclipse/sw360/pull/1682)
  - [https://github.com/eclipse/sw360/pull/1503](https://github.com/eclipse/sw360/pull/1503)

Support for Cyclone DX is on Roadmap
  - [https://github.com/eclipse/sw360/issues/1548#issuecomment-1146919177](https://github.com/eclipse/sw360/issues/1548#issuecomment-1146919177)

4 language GUI
- English, Vietnamese
- Japanese, New: Chinese
  - fix(language): Fix the properties file and add some other needed files for Chinese language support by shi9qiu - Pull Request #1820 - eclipse/sw360 (github.com)
02

Background;

Software Dependency
In nutshell; Why Dependency management is important

• Software dependency information is huge and complex

• It needs to be properly managed to comply with license obligations and to manage vulnerabilities.
Background About Software Dependency

The software dependency of a project refers to third-party open source software that this project depend on. Software dependencies can be direct or transitive.
Softwares in Dependency update version

Dependency graph is continually changing because of version updates, the different build time and build options, etc.
Software Dependency become large and complex

The dependency graph of a large project is very complicated

- E.g. A project depends on a npm package *grunt* is not only depends on *grunt*, but also depends on another 15 packages which are the dependencies of *grunt*. Meanwhile, each of these 15 packages has its own dependencies, constructing a large and complicated dependence graph.
Need to check all licenses in dependency software

Because of the complicated dependency graph, the obligation of the open source license of a dependency may be ignored.
Need to check all vulnerability in dependency software

Because of the complicated dependency graph, the vulnerabilities of a dependency may be ignored which will result in the security risk.
Dependency Management

The management activities towards the dependencies of a project
• Selecting the proper dependency
• Updating the outdated dependency
• Solving the risks caused by dependencies
Software Dependency registration issue in SW360
The issues caused:

- SW360 can register only one software dependency information.
- Different dependencies cannot be registered for different projects.
Data Architecture of SW360

Ex) Component: SW360, Release (≒ version): sw360-17.0.0-M1
How to manage the dependencies of a project in SW360

- Example: A project "Project Example1" depending on a npm package `minimatch 3.0.4`

```
Project Example1
```

- minimatch 3.0.4
- brace-expansion 1.1.11
- balanced-match 1.0.2
- concat-map 0.0.1
Dependencies registration on SW360 architecture

Example1 registered with SW360

- **Project Example1**
  - minimatch 3.0.4
  - brace-expansion 1.1.11
  - balanced-match 1.0.2
  - concat-map 0.0.1
SW360’s issue about dependencies registration

Example SW360 registration

Project Example1

- minimatch 3.0.4
- brace-expansion 1.1.11
- balanced-match 1.0.2
- concat-map 0.0.1

Registered Software Information

Add License Info to Release

- minimatch 3.0.4
- brace-expansion 1.1.11
- balanced-match 1.0.2
- concat-map 0.0.1
Use case: Register 2 projects dependencies

Use case: two products using "minimatch 3.0.4"

Project Example 1
- minimatch 3.0.4
- brace-expansion 1.1.11
- balanced-match 1.0.2
- concat-map 0.0.1

Project Example 2
- minimatch 3.0.4
- brace-expansion 1.1.07
- balanced-match 0.4.1
- concat-map 0.0.1

The same "minimatch 3.0.4" is used, but the dependent OSS versions are different.
Why Data Architecture of SW360 is bad for dependencies

Cannot register different dependency information for each project

Release link information is held by the component (the project does not)
Issue about dependencies registration of 2 projects

What we really need to do: is have a different tree structure for each project.
Issue about dependencies registration for new project

Manage the same component dependency information in different projects.

- minimatch 3.0.4
- brace-expansion 1.1.11
- balanced-match 1.0.2
- concat-map 0.0.1

Project 2 owner cannot register version 1.1.07 as dependency information
Issue about dependencies registration for existing Project

Manage the same component dependency information in different projects.

If you force a change in the link information, other related projects will also change their dependency information.
Solving Software Dependency Registration issue in SW360
How to solve Software Dependency registration Problems in SW360

Being able to register different dependency information for each project

By Updating “data architecture” and “GUI”

- The code can be found in the SW360 branch managed by Toshiba
  https://github.com/toshiba/sw360/tree/release/feature_dependency-network-management

- PR will be conducted soon.
Change the data architecture for dependencies registration in SW360

A new feature for dependency management in SW360
- Feature allowing project to set up its own dependency network

Old Specification

Project A
- Comp A Release1.0
- Comp B Release1.0
- Comp C Release1.0
- Comp D Release1.0

New Specification

Projects have independent Dependency Network

Project A
- Comp A Release1.0
- Comp B Release1.0
- Comp C Release1.0
- Comp D Release1.0

Project B
- Comp A Release1.0
- Comp B Release1.0
- Comp D Release1.0
- Comp C Release1.0

When link a Release to project, Release link info is common, it can’t be set for each project

Old Specification vs. New Specification
Change the GUI for dependencies registration in SW360

A new feature for dependency management in SW360
- Feature allowing project to set up its own dependency network

**Old Specification**

Unable to set link info for Release

**New Specification**

Can set link info for Release
New GUI for dependencies: Registration dependencies page

The functions of this new feature

• The Linked Releases And Projects tag (Edit page)

- "Add dependency" function
- "Select version" function
- "Delete dependency" function
- "Load default dependencies" function
New GUI for dependencies: Registration Component page

- The “release” page is not changed.
- The dependency information here will be seen as the place storing the “default” information. It will keep the same with the latest information in the ecosystem (maven, npm, etc.)

![Screenshot of the GUI](image-url)
New GUI for dependencies : View page

GUI: the “License Clearing” tag (View page)

Each dependency graph can be committed.
New GUI for dependencies: Edit page

GUI: the “Linked Releases And Projects” tag (Edit page)

Each dependency graph can be committed.
SBOM standards format define dependency
How to use SBOM to manage dependency

- SBOM (Software Bill of Materials)
  - Formats: SPDX and CycloneDX are two widely used formats.
  - Both Formats can describe Software Dependencies
Dependency in SPDX

<table>
<thead>
<tr>
<th>SPDX v2.3 Document shall contain:</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPDX Document</td>
</tr>
<tr>
<td>Creation Information</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SPDX v2.3 Document may contain:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package Information</td>
</tr>
<tr>
<td>File Information</td>
</tr>
<tr>
<td>Snippet Information</td>
</tr>
<tr>
<td>Other Licensing Information</td>
</tr>
<tr>
<td>Detected</td>
</tr>
<tr>
<td>Relationships between SPDX</td>
</tr>
<tr>
<td>Elements Information</td>
</tr>
</tbody>
</table>

### Example of SPDX elements Relationships

#### Example: Between two Packages

<table>
<thead>
<tr>
<th>Relationship Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEPENDS_ON</td>
<td>Package A depends on the presence of package B in order to build and run</td>
</tr>
<tr>
<td>DEPENDENCY_OF</td>
<td>A is explicitly stated as a dependency of B in a machine-readable file. Use when a package manager does not define scopes.</td>
</tr>
</tbody>
</table>

#### Example: Files relationship

<table>
<thead>
<tr>
<th>Relationship Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DYNAMIC_LINK</td>
<td>An APPLICATION file ‘myapp’ dynamically links to BINARY file zlib.so.</td>
</tr>
<tr>
<td>STATIC_LINK</td>
<td>An APPLICATION file ‘myapp’ statically links to BINARY zlib.a.</td>
</tr>
</tbody>
</table>

Represent a relationship between two different Files, between a Package and a File

* https://spdx.github.io/spdx-spec/v2.3/relationships-between-SPDX-elements/*
Dependency in Cyclone DX

CycloneDX provides the ability to describe components and their dependency on other components.

https://cyclonedx.org/use-cases/#dependency-graph

CycloneDX uses P-URL to denote dependencies
Future Work for SBOM standards
Future Work

The relationship types defined in SW360 are different from the important SBOM relationship types.

<table>
<thead>
<tr>
<th>SW360</th>
<th>SPDX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown</td>
<td>SPDX v2.3 Document shall contain:</td>
</tr>
<tr>
<td>Contained</td>
<td>SPDX v2.3 Document Creation Information</td>
</tr>
<tr>
<td>Referred</td>
<td>SPDX v2.3 Document may contain:</td>
</tr>
<tr>
<td>Dynamically Linked</td>
<td>Package Information</td>
</tr>
<tr>
<td>Statically linked</td>
<td>File Information</td>
</tr>
<tr>
<td>Side by side</td>
<td>Snippet Information</td>
</tr>
<tr>
<td>Standalone</td>
<td>Other Licensing Information Detected</td>
</tr>
<tr>
<td>Internal Use</td>
<td>Relationships between SPDX Elements</td>
</tr>
<tr>
<td>Optional</td>
<td>Information</td>
</tr>
<tr>
<td>To be replaced</td>
<td>Annotations Information</td>
</tr>
<tr>
<td>Code Snippet</td>
<td>Review Information</td>
</tr>
</tbody>
</table>

The definition of unique SW360 dependencies needs to be changed.
07

Summary
Summary

• SW360 can manage internal software information.

• Registration of dependency is important for license and Security management.

• Registration of dependency information software in SW360 was not flexible.

• We developed a function to register different dependency information for each project to be registered.

• The definition of relevance between software is unique to SW360.

• In the future, it will be adapted to the common SBOM definition.
Appendix

DEMO
Committed to People,
Committed to the Future.