A Standard BOM For Siemens

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Industry

Mobility

Smart Infrastructure

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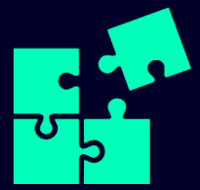
Siemens

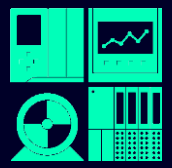
310k Employees

47k R&D Employees

50+ R&D Locations



120k Components Used



20+ Software Eco-Systems (JavaScript, Java, C#, Go, Python, Lua, Swift, …)

+25k New Components/Year

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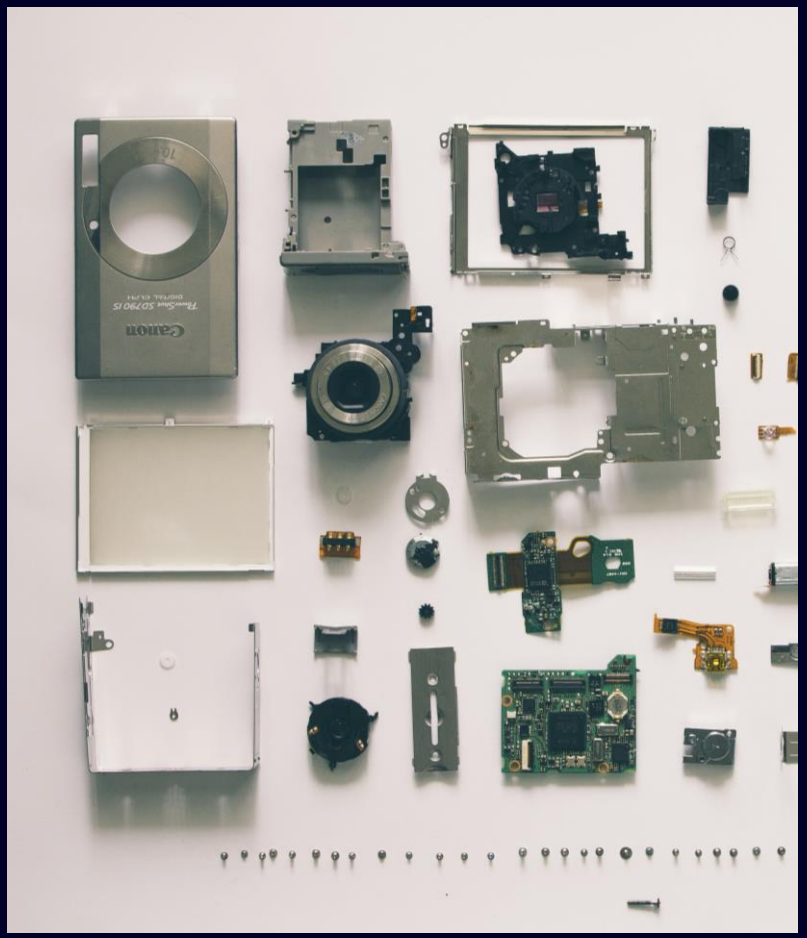
What is an SBOM - A Software Bill of Materials?

An SBOM is an inventory of components, a list of ingredients that make up a software product. It also ...

- is a formal, machine-readable document.
- includes information about the components, especially a unique identifier.
- gives the components' hierarchical relationships.
- should be comprehensive (or explicitly state where it could not be).
- may include OSS and proprietary software.
- can be widely available or access-restricted.
- should be generated automatically.

The primary purpose of an SBOM is to uniquely and unambiguously identify components and their relationships to one another.



https://pxhere.com/en/photo/969803 (CC0)

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SBOMs Are Created with a Specific Use Case In Mind

License Compliance

Use SBOMs to ensure that all obligations from OSS and other licenses are met.

- Rich and complete information preferred
- Source code required for all components(!)
- Used internally

Security Vulnerability Monitoring

Use SBOMs to enable monitoring of security vulnerabilities as they emerge.

- Slightly different fields required, such as CPEs
- Can include build tools and test frameworks
- Source code not needed
- Used internally

Regulatory

Use SBOMs to comply with regulations like U.S. EO14028 or the E.U. Cyber Resilience Act.

- Only strictly required content to minimize attack surface
- Source code not needed
- Published

All use cases have in common that the SBOM must be accurate and complete, including all transitive dependencies.

Software Bills Of Materials Are About Interoperability

Source Ecosystems
Libraries, Open-Source Software, Transitive Dependencies

3rd Party Vendors
Software Products, e.g. PostgreSQL, Nginx, …

Container Images
Built and/or consumed, Base Images, Layers

Partner Companies
Components provided by partners may come with their own SBOMs.

Siemens Business Units
Our own internally developed Inner Source components have SBOMs.

… and more
The list goes on.

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1 Nearly every team is different

- No silver bullet
- No universal automation approach

2 We need to have a set of tools

- In order to simplify SBOM generation / software license automation for our developers
- Inner source or open source

3 We need to have simple to use libraries

- When there are no specific tools
- When teams need customization
- Inner source or open source

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For Us It Is Important To Get Our SBOMs Right

Security

Identification of vulnerable products only possible if SBOMs are accurate

Quick reaction times for 0-days are essential

Cannot mitigate if you don't even know your product is vulnerable

Compliance

Failure to comply with the license terms of third-party components can lead to litigation

Lawsuits are time-consuming and expensive

Claims for compensation can easily reach **millions of $$$**

Worst case: an injunction may prohibit the sale of affected products

Both scenarios are a PR nightmare if a company gets them wrong!

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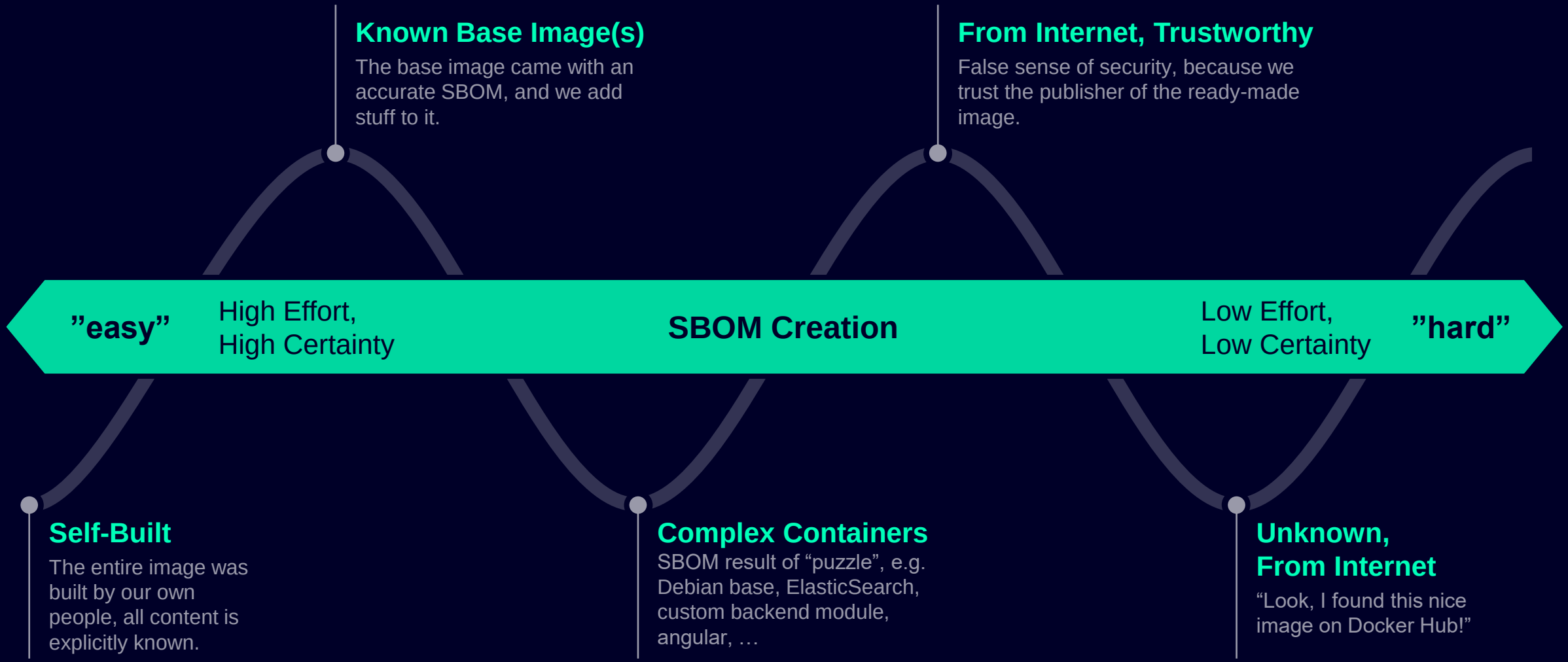
Container Images Present a Special Challenge When Creating SBOMs



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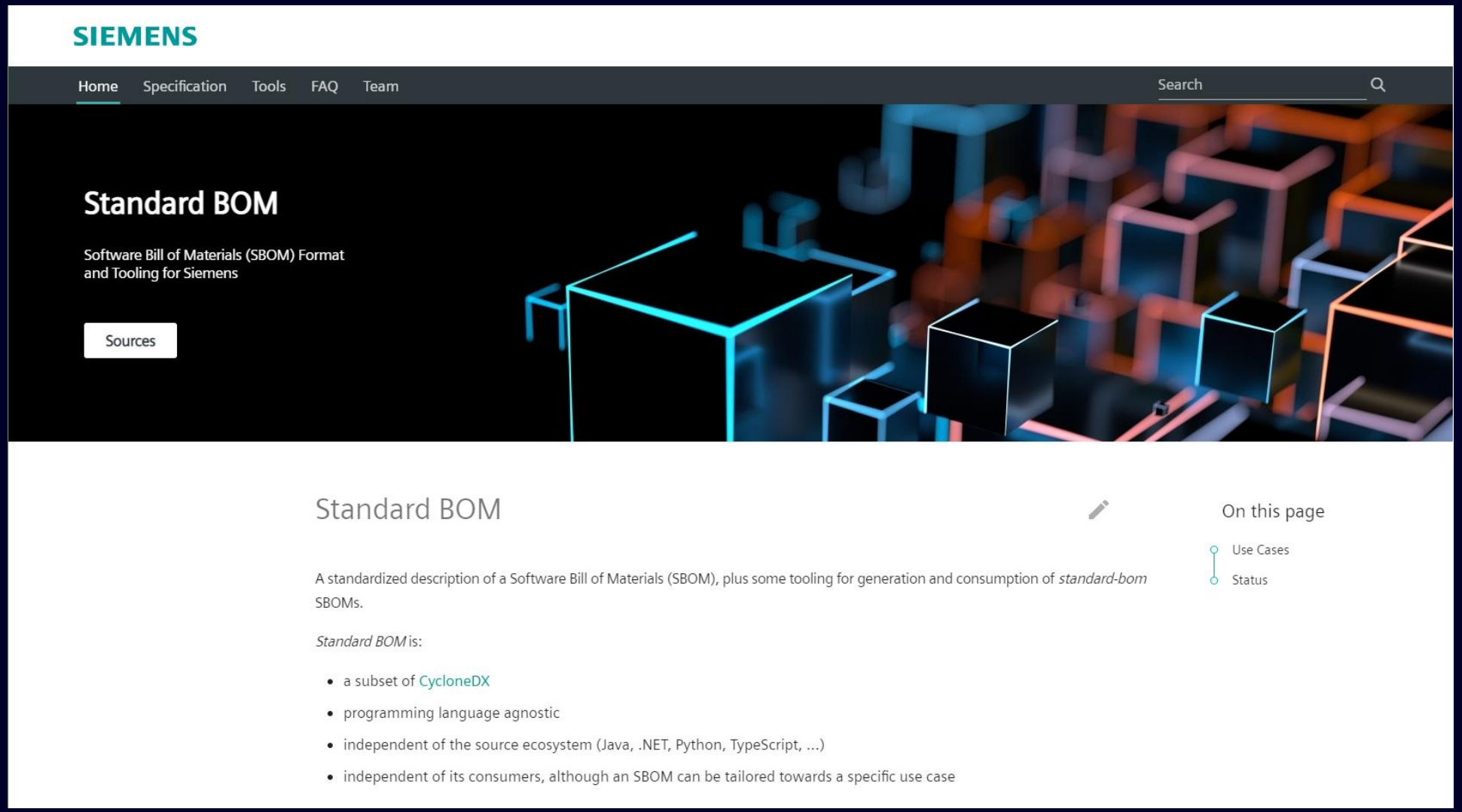
A common SBOM format and tooling for Siemens would be nice!

https://sbom.siemens.io



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What Is This Siemens Standard BOM?

The Siemens Standard BOM is a standardized SBOM format with tooling for Siemens.

It is

- a subset of OWASP CycloneDX
- programming language agnostic (It's just JSON)
- independent of the source ecosystem (Java, .NET, Python, TypeScript, ...)
- independent of its consumers, although an SBOM can be tailored towards a specific use case (for example, it works with different Siemens software clearing toolchains)

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Why Should We Have Standard BOM Rather Than Plain CycloneDX?

- Standard BOM is a proper subset of CycloneDX.
- SBOM components are presented in *list form*, not as a tree.
- Custom properties are not random free-form Strings as per CycloneDX, but elements from the Siemens Property Taxonomy for CycloneDX. CycloneDX reserves a `siemens` namespace for Standard BOM.
- *Component Sources* can be specified.
- A Standard BOM Package bundles the SBOM document with any referenced files, such as component sources or binary archives.

```
"properties" : [ {
    "name" : "siemens:direct",
    "value" : "true"
  }, {
    "name" : "siemens:filename",
    "value" : "commons-codec-1.13.jar"
  }, {
    "name" : "siemens:primaryLanguage",
    "value" : "Java"
  }, …
],
```

```
"externalReferences" : [
  {
    "type" : "distribution",
    "url" : "file:sources/a11bdc0e8f…a35c23e197498d/log4j-api-2.11.2-sources.jar",
    "comment" : "source archive (local copy)",
    "hashes" : [ … ]
  }, {
    "type" : "distribution",
    "url" : "https://repo.maven.apache.org/maven2/…/log4j-api-2.11.2-sources.jar",
    "comment" : "source archive (download location)",
    "hashes" : [ … ]
  }, …
```

Example:
BOM Entry for Java Library


```
{
  "type": "library",
  "author": "Henri Yandell <bayard@apache.org>, Tim OBrien …",
  "group": "commons-codec",
  "name": "commons-codec",
  "version": "1.13",
  "purl": "pkg:maven/commons-codec/commons-codec@1.13?type=jar",
  "description": "The Apache Commons Codec package contains …",
  "hashes": [ … ],
  "licenses": [ {
    "license": {
      "name": "Apache License, Version 2.0",
      "url": "https://www.apache.org/licenses/LICENSE-2.0.txt"
    } } ],
  "externalReferences": [ …
    {
      "type": "distribution",
      "url": "file:sources/2…d/commons-codec-1.13-sources.jar",
      "comment": "source archive (local copy)",
      "hashes": [ … ]
    }, {
      "type": "website",
      "url": "https://commons.apache.org/proper/commons-codec/"
    },
    {
      "type": "vcs",
      "url": "https://github.com/apache/commons-codec"
    }
  ],
  "properties": [
    {
      "name": "siemens:direct",
      "value": "true"
    }, {
      "name": "siemens:primaryLanguage",
      "value": "Java"
    }, {
      "name": "siemens:thirdPartyNotices",
      "value": "Apache Commons Codec\nCopyright 2002-2019 The ↲
        Apache Software Foundation\nThis product includes software ↲
        developed at\nThe Apache Software Foundation ↲
        (https://www.apache.org/).\nsrc/test/org/apache/commons↲
        /codec/language/DoubleMetaphoneTest.java\ncontains test …"
    }
  ],
  "copyright": "Copyright 2002-2019 The Apache Software …",
  "bom-ref": "pkg:maven/commons-codec/commons-codec@1.13?type=jar"
}
```


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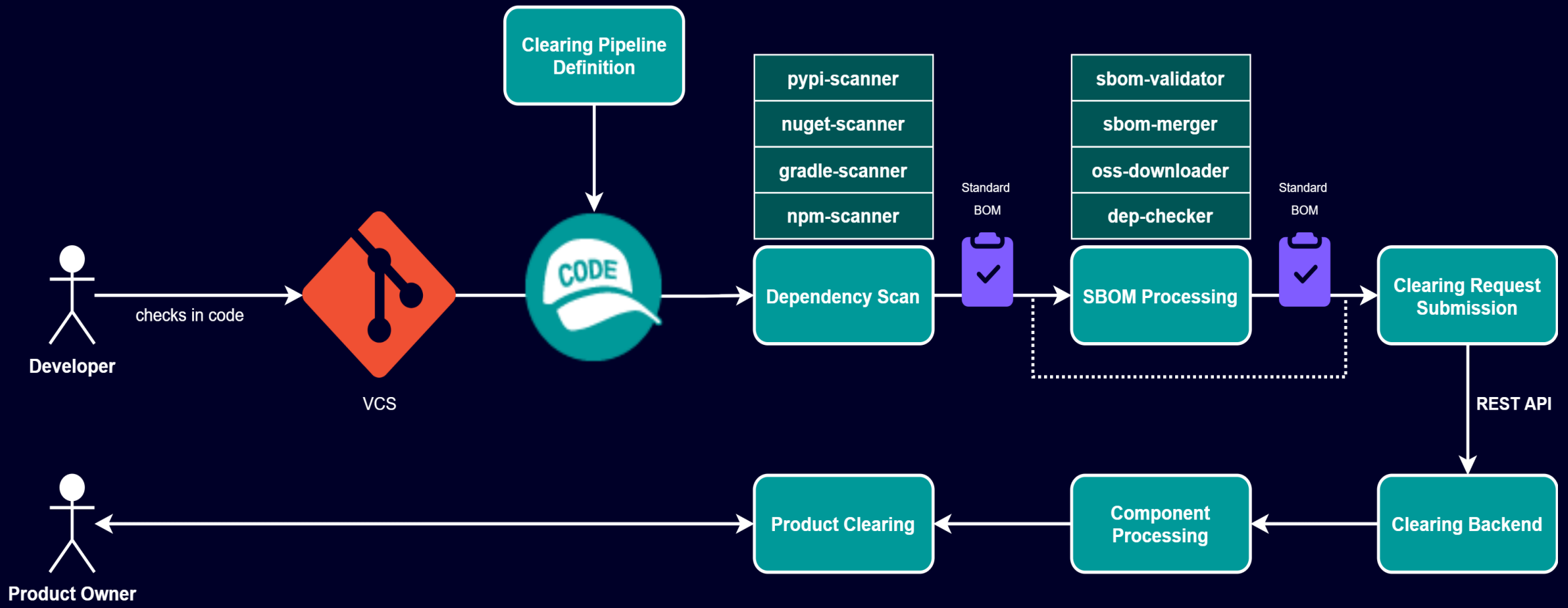
Standard BOM is Great For Automated Pipelines Which Need SBOMs
Example: Software License Compliance



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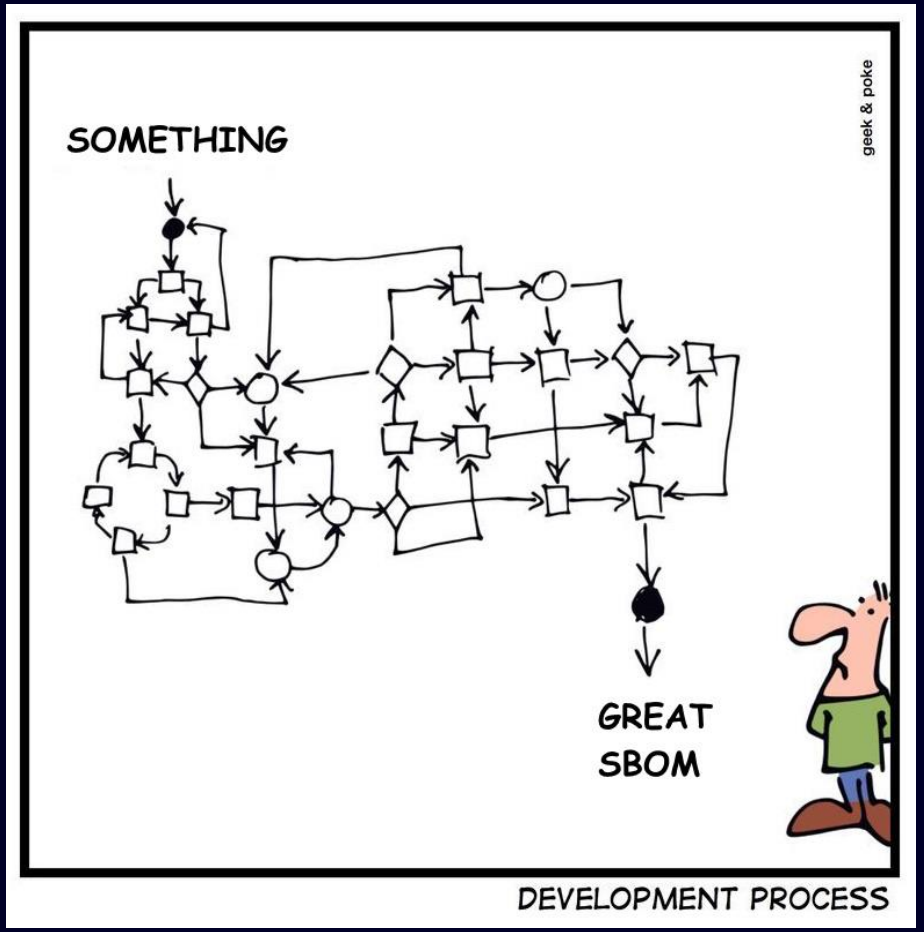
Road To Collaboration

We presented our experiences and our approach on SBOMs.

We could imagine that some of our tools are upstream contributions or candidates for open-sourcing.

➔ Would you like us to open-source these tools?

➔ Some of our tools are from-scratch implementations of existing OSS tools – we do not want to *compete*, but rather *collaborate* with them



Based on https://geek-and-poke.com/

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Q&A

- Siemens product portfolios are complex, therefore SBOM generation is also complex.
- SBOMs are created with a particular use case in mind.
- A common format facilitates internal collaboration on SBOM tooling.
- Accurate and complete SBOMs are key.
- SBOMs as a cross-cutting concern work better when developed and introduced collaboratively.
- Containers prove particularly challenging.
- CycloneDX is great, but from a consumption perspective, some things need to be more concrete.
- SBOM are puzzles, you must combine many things to get an accurate SBOM.

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BACKUP

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The „Standard BOM Package“

Used for handling file system references in the SBOM.

Objective: Self-contained package

All external references used in the SBOM must be either

- URLs of publicly available resources on the Internet, or
- a relative file system path.

Resources referenced via relative paths become part of the self-contained "Standard BOM Package", which is a ZIP file or file system folder.

```
sbom.json
+--- binaries
|    +--- 77100a62c2e6f04b53977b9f541044d7d722693d
|    |    `--- some-binary.jar
|    +--- 8031352b2bb0a49e67818bf04c027aa92e645d5c
|    |    `--- another-binary.jar
|    `--- (... more ...)
`--- sources
     +--- 6bb10559db88828dac3627de26974035a5dd4ddb
     |    `--- some-binary-sources.jar
     +--- 4d44e4edc4a7fb39f09b95b09f560a15976fa1ba
     |    `--- another-binary-sources.jar
     `--- (... more ...)
```