AboutCode Foundation

How PURL transforms OSPO operations

with Philippe Ombredanne, AboutCode

Agenda

OSPOs challenges: The world is changing fast

History of the SBOM world: Before and after mandated compliance

What is PURL? Introduction to Package-URL

Benefits for OSPOs: Unified license compliance, faster vulnerability responses, consistent workflows, and vendor-neutral tooling

How can we fix supply chain clarity? Community efforts

Latest developments: Current status and roadmap

Calls to action: Encouraging community participation

FOSS-first mission: Make it easier to reuse open source, safely and efficiently, with open source code and open data

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- Lead maintainer of AboutCode
  - Open source code, data, and standards to automate and secure software supply chains with transparency and confidence
  - https://aboutcode.org
- Creator of PURL (Package-URL) and VERS, co-founder of SPDX and ClearlyDefined, and core contributor to CycloneDX
- CTO and co-founder of nexB
  - Providing SCA services and AboutCode support since 2007
  - https://nexb.com

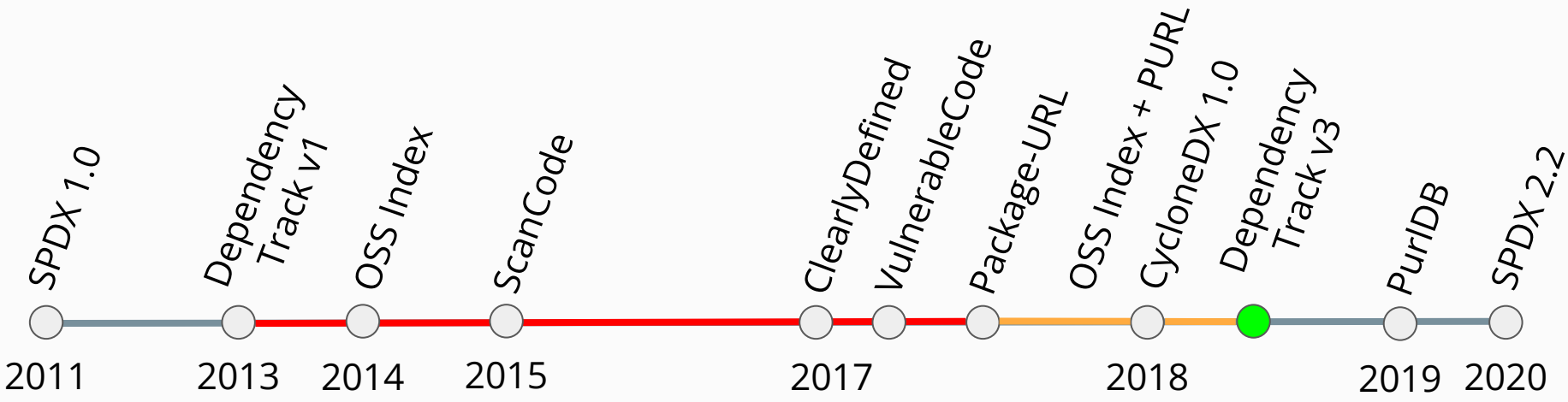
Managing enterprise-wide open source adoption

- Volume of FOSS is exploding
  - Reused and contributed
- Less budget and resources
  - Imperative to automate (almost) everything
- More compliance requirements
  - From license and origin to security, project health, and LLMs
  - CRA, NIS2, DORA and more
- Confusing tooling landscape
  - Both commercial and FOSS
- Emerging, conflicting standards for SBOMs and VEXs
- Difficult to navigate security and software development
- AI (especially GenAI) changes everything

How PURL transforms OSPO operations

1. Unified license compliance
2. Faster vulnerability responses
3. Consistent workflows
4. Vendor-neutral tooling

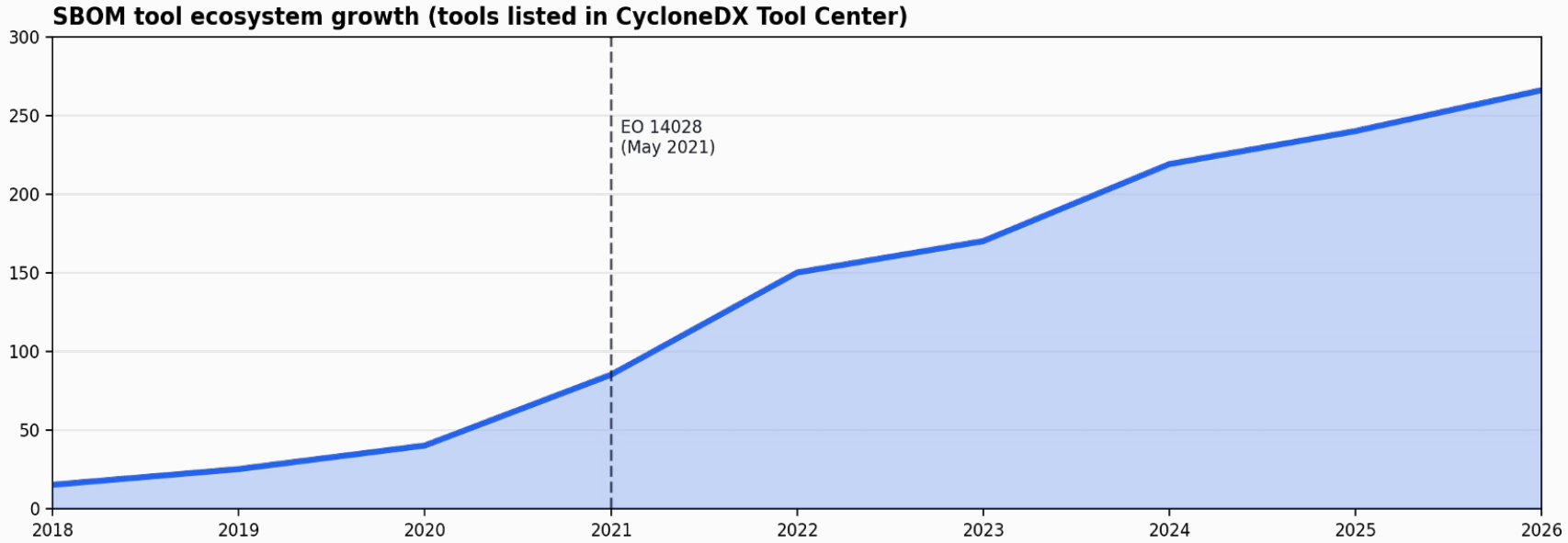
History of the SBOM World, Part 1



History of the SBOM World, Part 2

- Vulnerability management = primary use case
    - Human-readable AND machine-parseable software identifiers
        - Hash/checksum=GPS coordinates vs. PURL=street address
    - Portable inventory of components
    - Provenance of components

History of the SBOM World, Part 3



PURL made it all happen.

SBOMs describe software composition.

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PURLs make those descriptions machine-readable and actionable.

PURL is the standard for package identification across ecosystems

- Package-URL (PURL) is the glue between all your software supply chain tools, data, and standards
  - Adopted in all SBOM and VEX specs
  - Most SCA tools
  - Many vulnerability databases
- Across Dev to Ops to Sec (to DevSecOps)

- Simple, obvious, expressive syntax:
  - `pkg:npm/file@1.9.1`
  - `pkg:deb/ubuntu/7zip@21.07+dfsg-4`
  - `pkg:pypi/django@1.11.1`

- Ecma standard at TC54
  - Planned ISO JTC1 standardization
  - Already included in CycloneDX, OASIS, ISO CSAF, ISO SPDX, and CVE schema

and VERS is a new standard for version ranges syntax

- Problem: Each ecosystem has its own convention to specify version ranges
- Solution: An expressive version range string that is minimal and PURL adjunct
    - Specify ranges reliably across tools and languages for dependencies and vulnerabilities
    - Path to universal dependency resolution and better vulnerability remediation automation
- A version range specifier (VERS) is a URI with this syntax:
    - `vers:npm/1.2.3|>=2.0.0|<5.0.0`
    - `vers:pypi/0.0.1|0.0.2|2.0pre1`
- Started with VulnerableCode in the "univers" library and now used in CycloneDX, CLE, TEA, CSAF and ScanCode
- Planned Ecma standardization with TC54-TG2 in Q2 2026

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Use PURL for origin and SPDX for license

PURL for accurate package origin

+ SPDX license expressions for accurate licensing documentation

= Unified policies, streamlined compliance

- Easy creation of accurate attribution notices
- Easy injections in SBOMs (Cyclone and SPDX)
- Easy policies based on accurate identifiers
  - At the license expression level
  - Or at the PURL + license level
  - And in the context of a product or usage
- This makes automation possible
  - SBOM validation, compliance reporting, vulnerability management, and more

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It’s Saturday, September 12th, 2026.

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A key provision of the EU CRA went into effect yesterday.

You sell your software in Europe. The CRA categorizes it as a "*critical digital product*".

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And a vulnerability was just discovered in your software...

You have 24 hours to process and report!

Reporting vulnerabilities for CRA

1. Continuously track all the third-party packages used in all products
    - And how they are used
2. Continuously watch for known vulnerabilities
    - And listen to reported incidents
3. Determine exploitability
    - What are the process, teams and tools you need to achieve this?
4. Send reports to national CSIRTs and ENISA

- 24 hours: Report known-to-be-exploitable vulnerabilities
- 72 hours: Detailed reports
- 14 days: Final Reports

- Watch "Mission Possible: 24 Hours To Save The World With Security Compliance" for more information: https://sched.co/28XRP

1. Continuously track all the third-party packages used in all products

- Collect package inventories (SBOMs)
  - Minimum viable = subset of packages in the deployed product
  - Know what's in your software
  - Keep track of each shipped product details for 5 years

- Standardized SBOM format interoperability ensures consistent identification across formats and tools
  - Reference the same package using identical PURL identifiers

CycloneDX

https://cyclonedx.org/docs/1.6/json/#components_items_purl

SPDX®

https://spdx.github.io/spdx-spec/v3.0.1/model/Software/Properties/packageUrl/

2. Continuously track known vulnerabilities

- How to get a reliable vulnerabilities feed, open and keyed by PURL?
  - NVD CVE backlog is growing and CPEs do not help [1]
  - 38% growth rate in CVEs from 2023 to 2024 [2]

- Go upstream, straight from the source: Data directly from projects
  - GitHub advisory database and Google OSV are also doing a good job there
  - Too much noise with junk CVE, malware (no CVE for this!), unmaintained code…
- Need contextual severity to prioritize work and determine reachability
  - Use code reachability and static and dynamic analysis!

[1] Lyons, Jessica. “NIST’s security flaw database still backlogged with 17K+ unprocessed bugs. Not great.” The Register, 2 Oct. 2024, www.theregister.com/2024/10/02/cve_pileup_nvd_missed_deadline.
[2] "Metrics." CVE: Common Vulnerabilities and Exposures, 25 Aug. 2025, https://www.cve.org/about/Metrics.

2. Continuously track known vulnerabilities: 4 types

1. CI/CD pipeline scanning what's being deployed
    - At code build in CI/CD pipelines
2. Scanning artifactory stores
    - At artifact ingestion with Jfrog Artifactory, package registries
3. Monitoring cycle for the whole release
    - Global monitoring with DejaCode (or DependencyTrack)
4. Checking for current and past releases
    - Important that current releases include no known vulnerabilities
    - Critical to also ensure for previous releases!

2. Continuously track known vulnerabilities: Formats

- Standardized VEX and VDR format interoperability
  - Precise vulnerability matching and license compliance checking with accurate package identification
- Faster vulnerability correlation and incident response
  - Query a single PURL-indexed database rather than hunting across multiple

CycloneDX

https://cyclonedx.org/docs/1.6/json/#components_items_purl

CVE

https://github.com/CVEProject/cve-schema/releases/tag/v5.2.0

OpenVEX

https://github.com/openvex/spec/blob/main/OPENVEX-SPEC.md#appendix-b-software-identifier-types-table

CSAF

https://docs.oasis-open.org/csaf/csaf/v2.0/os/csaf-v2.0-os.html#31334-full-product-name-type---product-identification-helper---purl

OSV

https://google.github.io/osv.dev/post-v1-query/#parameters

3. Determine exploitability

- Historically delegated to US NVD for definition and severity, but not a sustainable process…
  - NVD backlog still growing
- SO MANY QUESTIONS!
  - What is a vulnerability? Who defines that? Is any bug a vulnerability? (See the kernel CVEs)
  - How to determine exploitability? In general? Or in a specific usage?

- Data sources for exploitability:
  - EPSS (Exploit Prediction Scoring System)
  - US CISA KEV (Known Exploited Vulnerabilities)
  - Exploit scripts in VulnerableCode

3. Determine exploitability, practically

- Traditional industry approach = ask dev teams to investigate 😓
  - Developers are not experts
  - Too many vulnerabilities and data feeds now
  - Developers drowning in security work

- Instead, reduce the number to investigate
  - Remove internal use, and rescore
  - And only a few developers see full end-to-end environment
  - Difficult to determine how and where packages are used
- Then, investigate exploitability
  - And the internal context
  - And link SBOMs to product code

4. Send reports to national CSIRTs and ENISA

- How? And to whom? Still unclear …
- The what is clearer:
  - A machine-readable SBOM = an inventory of third-party (and own) packages
  - A vulnerability disclosure report (VDR) or similar vulnerability exploitability report (VEX) = an assessment of the vulnerabilities, their impact, and possible remediation
- This will be publicly available as a disclosure
  - Need to ensure data is accurate
  - Reporting structure will be challenging for proprietary embedded in software supply chains
    - FOSS usage update cycle (usually) faster than proprietary
    - System and network admins already implement quickly, but developers will need help

/end rant

>>> back to main topic

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Enable efficient automation

- With PURL, automation is possible
  - Clear automated outcomes
  - Only handle policy exceptions
  - Automate all the rest!

- Consistent approval workflows for diverse development teams
  - Engineering teams using different stacks all feed into the same OSPO review pipeline
  - Teams don't need ecosystem-specific workflows for npm vs. Maven vs. PyPI
    - One identifier schema covers all of them

And actionable SBOMs and SCA

- You get an SBOM. With a correct PURL, you can lookup for:
  - Vulnerabilities
  - Licensing
  - Quality/Sustainability/Lifecycle
  - Internal policies

- You share a VEX. With a correct PURL, upstream suppliers and downstream users will not come back with inquiries about packages.

- You scan code. With correct PURLs, results can flow through your toolchain without any friction.

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Choose the best tools for your use case

- Security scanners and compliance tools can reliably match packages using PURL as a common identifier:
  - SCA
  - Security
  - Vulnerability databases
- Correct PURLs facilitate accurate tracking of components through the entire software supply chain, from development to deployment.

PURL is adopted industry- and community-wide

All open source SCA and SBOM tools use PURL, including:

- AboutCode's ScanCode and DejaCode
- Linux Foundation's ORT and Fossology
- OpenSSF OSV and GUAC
- OWASP Dependency-Track, Dependency-Check, and cdxgen
- All OWASP CycloneDX libraries
- GitHub's Dependency Graph
- Microsoft's OSS Gadget, SBOM tool
- Anchore's Syft and Grype
- Aquasec's Trivy
- LG's FOSSLight
- SCANOSS
- Snyk's Parlay

Most proprietary SCA, SBOM, and code host tools use PURL, including:

- GitHub
- GitLab
- Snyk
- Mend
- BlackDuck
- Sonatype

Vulnerability databases use PURL, including:

- Google's OSV
- Sonatype's OSS Index
- CVE specification v5.1
- VulnerableCode

PURL facilitates better compliance processes for end users, including:

- Most free and open source software foundations
- Five of the Big Tech companies, with three building their entire SCA compliance operations on PURL
- A leading database company
- A leading Linux company
- European and US government agencies
- All major European car manufacturers and most of their vendors
- Major US chip and microprocessor providers
- Four leading European industrial companies
- A leading European medical devices company

Community adoption is great.

But, we now need better and standardized PURLs.

How can we fix supply chain clarity?

SBOM clarity is … a work in progress

2024 SCA for Containers Report:

- Compared SCA tools for container scanning using SBOM accuracy as proxy
- The results were not great…
- Some invented Package IDs and invalid PURLs, lots of "creativity"
- Download report: https://nexb.com/sca-containers
- Watch talk from OSS Summit EU 2024: https://sched.co/1ej58

2025 CMU SEI's SBOM Plugfest Report:

- Compared SCA tools using SBOM accuracy as a proxy
- The results were not great … again.
- Inconsistencies on the format and content across many tools
- Download report: https://www.sei.cmu.edu/news/study-finds-key-causes-of-divergence-in-software-bills-of-materials/

Validate PURLs

- Extensive test suite as data (JSON)
  - Build compact dataset of all known PURLs to validate if a PURL exists
    - Using automatons, DAWG, FSTs, etc
  - Supported by distributed jobs to continuously catalog all the PURLs
  - Collect all Maven, Rust, npm and more (using existing PurlDB code)
  - Package as libraries with code and data (in Python, Go, and more)
- ... will be completed by validation service API (online) that could can also deploy on-premises
- Need to support that for all PURL libraries (JS, Ruby, C#, C, etc.)

Create a PURL benchmark

- Thoroughly validated set of open source app, container and package codebases
- Goal = Scanning tools can check they return the exact list of correct PURLs found in a codebase
  - Peer reviewed and updated!
  - Precursor to a future open SBOM benchmark
  - PURL-first
  - Support both SPDX and CycloneDX
- Call to Action = Let's join forces!
  - OpenChain and Bosch "Digital Dummies" project: https://github.com/Open-Source-Compliance/Sharing-creates-value/tree/openchain_and_friends_2026_prep/Tooling-Landscape/Dummy_Repositories
  - Nokia SBOM-QA.org project: https://nokia.github.io/SBOM-QA/
  - AboutCode PURL benchmarks

How to integrate PURLs into your tooling and workflows

- Improved test suite from Ecma standardization work on PURL
- Libraries are getting up to speed on support for ECMA-427, and we are helping as much as we can
    - We need YOUR help!
- No more excuses if your tools, FOSS or proprietary, produce junk PURLs! 🗑️
    - Some are really funky! 🎷
- Demand from all your supply chain partners to provide VALID PURLs
    - Or reject their SBOMs/VEXs

Ecma TC54 for software and system transparency

- Covers PURL and VERS (standard for version ranges)
  - https://github.com/Ecma-TC54/tg2
  - PURL and VERS are already part of EcmaISO standards, indirectly with CSAF 2.0 and SPDX 2
- Active participation by key community contributors, industry players and open source foundations

- TC54 started for CycloneDX
  - CycloneDX is now **ECMA-424**
- PURL and VERS in CycloneDX specs
  - PURL is now **ECMA-427**
- Includes TEA (Transparency Exchange API) and CLE (Common Lifecycle Events) task groups
  - CLE is now **ECMA-428**
- Other TG for Contributing.yaml

Better PURLs? Yeah!

- ✅ A standard with Ecma International
- ✅ Structured PURL types as data (JSON)
- ✅ Open source tools to validate PURL syntax
- ✅ Open data (and tool) to validate existence (offline) in Go, Python, Rust
- ✅ Validation service API (online)
- ✅ Extensive test suite as data (JSON)
- ✅ Adoption in language ecosystems
  - Perl, PEP 725 in Python, Raku
- ✅ PURL adopted in the CVE schema, Maven Central, and for all Rust crates in crates.io
  - Beach operations cleaning packages for Rust, Maven, and nixpkgs
- ✅ Work with PURL library maintainers
  - Adopt test suites (Java, Go, Rust, Perl, Ruby, JavaScript, Raku, etc...)
  - Upgrade to the latest standard
- ✅ Expose open metadata and scans, keyed by PURL

What's next for the PURL community

- More open source tools and open data to validate PURLs
- Validate package source vs. binaries?
- AboutCode + ClearlyDefined
  - Share all the scans, all the SBOMs
- AboutCode + Software Heritage
  - Scan billions of files
  - Get billions of PURLs

- ✅ PURL adopted in the CVE schema
- ✅ PURL for all Rust crates in crates.io
- ✅ PURL for all JARs at Maven Central
- Adoption in language ecosystems
  - Perl, PEP 725 in Python, Raku
- Commando beach operations cleaning packages for Rust, Maven, and nixpkgs
- New website 😍
  - https://packageurl.org/

New developments

ClearlyDefined

Ecosystem challenge:

- Generate SBOMs at scale for every build or release.
- And fix the same missing or wrongly identified metadata, again.

ClearlyDefined crowdsources a global database of licensing and metadata

- 55M+ packages soon keyed by PURL!
- Unlocking the data for distributed on-prem usage

ECOSYSTEM

OSS Review Toolkit · OPENCHAIN · AboutCode · SBOM · SPDX · CycloneDX · TODO · fossology · SW360 · GUAC · FOSSLight · OWASP

ORGANIZATIONS

Microsoft · GitHub · HPE · Bloomberg Engineering · kusari · ECLIPSE FOUNDATION · cisco · SAP · THE LINUX FOUNDATION · OPENRAIL ASSOCIATION

PURL (and VERS) need you!

- PURL types for your ecosystems!
- VERS standardization at Ecma, then ISO
  - Already included in CycloneDX, OASIS and ISO CSAF
- Help all CVEs contain (correct) PURLs
  - Open benchmark to validate SBOM accuracy (or rather PURL accuracy)
- PURL+VERS-based general purpose dependency resolution
- **C/C++ PURL open registry with C++ community**
  - And beyond C/C++
  - The missing registry for packages that do not have a registry
- PURL-keyed standard API for every ecosystem
  - We must stop rewriting API parsers and remapping package metadata schemas everywhere

Community support to help us do good!

- German Sovereign Tech Agency (STF) to support PURL and standardization
- Grants from NLnet Foundation with the EU NGI programs all about PURL:
  - CRAVEX, FederatedCode, T-Rust, back2source, Maven Heaven
- Grants from EU NGI Search:
  - AI-Generated Code Search, matching PURLs
- Completed GitHub Secure OSS Fund
- EU and ECCC (European Cybersecurity Competence Centre)-funded OCCTET project: occtet.eu
  - with Eclipse, DoubleOpen, Bitsea, European Digital SME Alliance, Expertware, Red Alert Labs
- ZEISS FOSS Award, Bloomberg FOSS Grant, Mercedes FOSS grant, Microsoft grant
- And grants from from two US big tech, two large US and several EU companies
- Help us do more!

Together, we can build better software compliance processes

Join the community and contribute!

AboutCode

GitHub: github.com/aboutcode-org

Slack: join.slack.com/t/aboutcode-org/shared_invite/zt-1paqwxccw-luafuiAvYJFkTqGaZsC1og

Community calls:
Mondays at 15:00 UTC at
meet.jit.si/AboutCode

TC 54 PURL + VERS

github.com/package-url/purl-spec

Join #purl channel on AboutCode slack for latest updates

Community calls:
Biweekly on Wednesdays at 16:00 UTC at
meet.google.com/ryq-aimn-ghd

Help with the 200+ issues:
github.com/orgs/aboutcode-org/projects/52/views/39 and
github.com/package-url/purl-spec/issues

ClearlyDefined

docs.clearlydefined.io/docs/get-involved/

CycloneDX

cyclonedx.org/participate/contribute/

SPDX

spdx.dev/engage/participate/

Let's connect!

Any questions?

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